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NOTES AND COMMENTS

World Raw Sugar Prices.

After sharp fluctuations in sugar prices in October, relative stability at lower levels returned to the market in November until political unrest in Cuba produced a fairly sharp advance. The world spot price in New York remained between 3·70 and 3·50 cents a lb through most of November, but rallied to about 4 cents in early December.

Under the lead of the New York market, world sugar prices declined sharply in the second week of December. Influences have been cheaper offers of Brazilian raw sugar again, improved beet crop prospects in Europe (estimated at 193,000 tons higher by LICHT than his previous estimate[1]) and assurances from the Cuban Government that the burning of cane fields would not interfere to any extent with the grinding of next year's crop. A Presidential, Decree was also issued in Havana authorizing Cuban mills to start grinding cane between 5th December and 10th January, and any later start must have special authorization. This is an early start as the opening date is usually mid-January, but this crop several mills have reported their readiness to start immediately.

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International Sugar Council.

The International Sugar Council met in London on 28th November 1957 under the chairmanship of Mr. G. S. BISHOP, O.B.E. (United Kingdom). The meeting was attended by delegates from twenty-three countries and by observers from five other countries and from the Food & Agriculture Organization of the United Nations.

The Council noted that twenty countries had ratified the Protocol amending the International Sugar Agreement. Ratification by the remaining countries parties to the Agreement was expected to take place in the near future. The Council renewed the invitation to the governments of these countries to continue to be associated with its work.

The Council took note of an estimate prepared by its Statistical Committee of free market requirements for the calendar year 1958 amounting to a total of 5,515,000 metric tons, raw value. Details of the estimate will be published in the next issue of the Council's Statistical Bulletin.

After considering that estimate and other factors affecting the supply and demand for sugar on the free market, the Council assigned, as initial export quotas for the calendar year 1958, the basic export tonnages for countries at present participants in the International Sugar Agreement of 1953 as set out in Article 14 of that Agreement as amended in 1956. The total of these initial export quotas and of certain other permissible exports under Article 14 of the Agreement is 4,865,000 metric tons, raw value. A list of the individual export quotas and permissible exports is given on page 27 of this issue.

It was also decided, under Article 18(4) of the Agreement, to set up a reserve of 20,000 metric tons from which additional export quotas may be allotted to meet special cases of proved hardship.

The Council considered a report prepared by the Committee, set up during its Thirteenth Session, to examine the situation created by the then current world market price of sugar. It noted the conclusion of the Committee that the action prescribed by the Agreement and the further action taken by the Council had resulted in increased supplies of sugar being made available to the market and had proved as effective as possible within the terms of the Agreement and of the circumstances of the time.

The Council unanimously elected Mr. D. J. MUIR (Australia) as its Chairman and Mr. D. A. BRUCE MARSHALL (Canada) as its Vice-Chairman for 1958; and appointed its Executive, Statistical and Finance Committees for that year.

The Council put in hand preparatory work in connexion with the arrangements for the negotiation of a new International Sugar Agreement before the end of 1958.

The next meeting will be held at a date in March 1958, unless circumstances make an earlier meeting necessary.

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Restoration of Sugar Quotas.

The quotas and other limitations on exports of sugar provided for in the International Sugar Agreement, which have been inoperative since 25th

[1] *I.S.J.*, 1957, **59**, 327.

January 1957, were restored on 19th November 1957, in accordance with Article 21(3) of the Agreement.* All participating governments have been informed accordingly.

On 23rd October the New York spot price fell below 3·90 cents per lb, under which level it remained for seventeen consecutive market days, i.e. until 18th November 1957. Thus the proviso in Article 21(3), which deals with the restoration of quotas and other limitations on exports, applies automatically after that date.

The restored quotas are applicable for the whole quota year and take account of various adjustments made during the inoperative period as a consequence of the redistribution of surrenders by some exporting countries. Details of the present position of quotas as compared with that preceding the inoperative period are as follows:—

	Quota on 25/1/57	Quota on 19/11/57
Belgium	50,000	15,000
China (Taiwan)†	655,000	758,264
Cuba	2,415,000	2,736,887
Czechoslovakia	275,000	118,000
Dominican Republic	655,000	728,742
France	20,000	0
Haiti	45,000	45,000
Hungary	40,000	4,740
Mexico	75,000	75,000
Kingdom of the Netherlands	40,000	0
Philippines†	25,000	5,000
Poland	220,000	80,000
U.S.S.R.	200,000	0
	4,715,000‡	4,566,633‡

* Under Article 21(3) quotas and other limitations on exports became inoperative on 25th January 1957, after the market price, as defined in the Agreement, had averaged 5·84 cents per lb for seventeen consecutive market days and had been above the higher price of 4 cents per lb referred to in that Article on the first day and on at least twelve days during that period.

† These figures do not include 95,000 tons allocated to China (Taiwan) and 20,000 tons allocated to the Philippines, under Article 14a (bis) of the Agreement.

‡ The difference between the two totals is due to the fact that 148,367 tons were surrendered too late in the year, and thus could not be redistributed.

If any participating exporting country exceeds its export quota by the end of the quota year it will not be penalised if it can be shown that such excess resulted from exports and sales to final destinations made during the period that quotas were inoperative.

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Commonwealth Sugar Agreement.

The Ministry of Agriculture, Fisheries and Food announced on 26th November 1957 that the series of meetings with representatives of the Commonwealth sugar exporting territories which began on 8th November had been concluded. Discussions had taken place on the price to be paid for 1958 "negotiated price" sugar under the terms of the Commonwealth Sugar Agreement and on other matters arising under the Agreement. Full agreement was reached as follows:—

Price for 1958.—The price to be paid for 1958 "negotiated price" sugar will be £43 16s 8d per ton £42 3s 4d in 1957).

Duration of the Commonwealth Sugar Agreement.—The Agreement has been extended for a further year and now runs to the end of 1965.

Quotas.—No change has been made in quotas. Arrangements have been made to enable British Honduras, as production expands, to increase exports within her maximum quota under the Agreement.

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U.S. 1957 Quotas.

The United States Department of Agriculture announced on 3rd December 1957 a reduction in its estimate of United States 1957 sugar requirements from 9,050,000 short tons, raw value, to 8,975,000 tons. At the same time, the Department announced the proration of deficits in Hawaii of 40,000 tons and the Philippines of 50,000 tons.

The new area quotas after the above reduction and proration of deficits are given below:—

Area	Short tons, raw value
Domestic Beet	2,070,694
Mainland Cane	637,172
Hawaii	1,060,000
Puerto Rico	920,000
Virgin Islands	14,753
Philippine Islands	930,000
Cuba	3,127,028
Peru	79,721
Dominican Republic	62,454
Mexico	44,586
Nicaragua	10,275
Haiti	6,333
Netherlands	3,551
China	3,485
Panama	3,485
Costa Rica	0
Canada	652
United Kingdom	533
Belgium	188
British Guiana	87
Hong Kong	3
Total	8,975,000

The announcement will also provide that refiners will be permitted, in the event of the last cargo arriving from any offshore area containing over-quota sugars, to melt such over-quota sugars during 1957 to the extent of 5% of the total quota for the area or 5000 tons, whichever is smaller[1].

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Dominican Sugar Production.[2]—Plans to increase sugar production in the Dominican Republic, announced by Azucarera Haina Co., include extensions to Central Consuelo costing over £700,000. This will enable the refinery at Consuelo to double its daily production and will permit the factory to keep its workers fully employed all the year round with no slack season. The Company is preparing 17,000 acres for the 1959 sugar crop. Azucarera Haina also state that their mill at Rio Haina will grind a record 1,500,000 short tons of cane in the 1957/58 season.

[1] *Lamborn*, 1957, **35**, 250.
[2] *The Times*, 11th December 1957.

THE SUGAR CANE IN THE WEST INDIES

PROCEEDINGS OF THE MEETING OF THE BRITISH WEST INDIES SUGAR TECHNOLOGISTS ASSOCIATION, 1955.

IN his opening address, Sir JOHN SAINT dealt primarily with the technological aspects of the industry and, in particular, with the question of by-products and of the organization best adapted to make early use of the results of research. It is, perhaps, unfortunate that inspiration is sought from the system established in England for this same purpose in 1946, since it has come under such severe criticism that it has formed the subject of a Committee of Enquiry.

Agronomy

The economic problems raised by the very specialized conditions under which cane is grown in British Guiana were discussed by H. EVANS. These conditions, marked by a high water table, stress the importance of drainage which, if defective, leads to high concentrations of reduced iron and manganese and of highly toxic sulphides. Pegassy soils may show high concentrations of iron, manganese and aluminium, to the last of which cane is very susceptible. In front-land areas salinity complicates the problem. The approach to these problems described in the paper is through analysis of water collected in 4–6 ft pits well protected from rain or surface wash. Lateral seepage, however, may vary greatly at different levels, perched water tables may exist, and the permanent water table may be under a pressure sufficient to raise the water level above ground level if the impervious superimposed stratum is pierced.

The water requirements of the sugar cane—a subject of particular importance in questions concerning the economy of irrigation—were dealt with at some length by I. R. CHINLOY and R. F. INNES. This is mainly concerned with PENMAN'S work on the relationship between the evaporation from a free water surface and from land with a vegetative canopy, work to which reference has already been made[1]. Here the discussion is given at greater length. The relationship obtained by the author under Jamaican conditions is shown to be very close and, using the figure 0·57, measurements of evaporation from a free water surface, consequently, can be used as a guide to irrigation.

Two papers describe field experiments. The first, by H. A. THOMPSON *et al.*, covers trials with aqueous ammonia, and the data suggest that the benefits are so small relative to those from sulphate of ammonia as to offset the price differential. The second, by J. J. E. MESTIER, briefly describes weed control in St. Kitts. Under the local conditions, which include no ploughing, pentachlorophenol and 2,4-D amine salt for pre-emergence treatment and the latter alone for later treatments, has proved effective.

For several purposes a knowledge of the quality of maturing cane is desirable, and R. B. AUSTIN and R. A. YATES compare the analysis of crusher juice with that of cane brei (macerated product resulting from sawing cane longitudinally) and of expressed juice. As the result of the work, analysis of cane brei has been adopted on several estates. Three papers by H. STEHLÉ are concerned with various aspects of arrowing in sugar cane. The first deals with the relationship between growth and arrows and the changes in juice quality as the result of arrowing. The latter question is considered in greater detail in the second paper, with the conclusion that sucrose %, brix, polarization and purity are generally lower in years of light arrowing. The third paper covers the relative susceptibility to borer of arrowed and non-arrowed cane; the former is, with few exceptions, found to be more susceptible to attack.

Cane Breeding

Varietal improvement was the subject of a paper by G. C. STEVENSON, a subject he has dealt with on more than one occasion[2]. He gives weighty evidence of the advantage of using inbreeding as a means of securing improved varieties with the minimum of effort. The practical difficulty lies in the fact that the parents are mostly high polyploids and aneuploids with a wide spread in the value of commercial characters in the offspring. Thus, of 701 seedling first year stools, thirteen were below 30 lb., three over 120 lb (max. 182 lb), and the average 53·6 lb. Further, the five leading commercial Barbados varieties are derived from seedlings whose first year stool weights ranged from 52 to 65 lb. The paper analyses separately, and from this aspect, the various commercial characters, yield, richness of juice, milling qualities, ratooning and resistance to diseases and pests. His concluding observation, however, is worth bearing in mind: environmental conditions are generally the dominant factor in cane production and the genotype must be tailor-made to suit prevailing environmental conditions.

Pathology

The presence of ratoon stunting disease in Jamaica is reported by C. E. M. SMITH, and a highly significant correlation between symptoms and yield is recorded. Cane which had shown symptoms at harvest, however, was sometimes found to be symptomless after six months.

Chlorotic streak is widespread in Jamaica, and its effect on B 4362 is reviewed by J. T. EDMOND *et al.*

[1] *I.S.J.*, 1954, **52**, 235.
[2] *I.S.J.*, 1957, **59**, 299.

Where infection was light, hot water treatment has a potential control value; but secondary infection, in areas of heavy incidence, renders such treatment ineffective.

Entomology

T. CHINLOY reported the survey of borer (*D. saccharalis*) infection in Jamaican sugar estates. This is directed to discover what change, if any, has resulted from the altered varietal position. The general conclusion is that the more popular varieties are more prone to attack than such older varieties as B 3439 and B 34104. The 1954 loss on a 220,000-ton crop from estate cane alone is estimated at 10,000 tons of sugar.

H.M.-L.

AGRICULTURAL ABSTRACTS

Assessing the Breeding Behaviour of S. spontaneum Variants. J. T. RAO and M. K. KRISHNASWAMI. *Indian J. Sugar Cane Res. Dev.*, 1957, **1**, 164–169.—The major characters of economic importance are evaluated for the large number of variants of *S. spontaneum* now in the Coimbatore collection. The assessment is mainly through repeated nobilization.

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Report of a Visit to Hawaii, 1956. G. C. STEVENSON. *Bull. B.W.I. Central Sugar Cane Breeding Station*, 1956, (38), 13 pp.—The Bulletin covers briefly the history of the Hawaiian sugar industry, the environmental conditions under which cane is grown, the agricultural practices including mechanization, and the breeding technique. Not unnaturally, emphasis is laid on the last of these and the differences in the Hawaiian and West Indian practices.

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Red Rot Disease in Northern Nigeria. *Ann. Rpt. Dept. Agric. Northern Region, Nigeria*, 1953–54, 101 pp.—Red rot disease (*Colletotrichum falcatum*) of sugar cane continued to spread and to be prevalent in all the main cane-growing districts of Northern Nigeria. Work on the selection of red rot resistant varieties was continued at Samaru and Maigana. The ravages of red rot have resulted in a decreased acreage of cane and a reduction in the output of brown sugar, the estimated output being 4243 tons as against 6833 tons for the previous year, the number of crushers operating being 563. In the variety trials at Maigana (Zaria Province) the local variety failed completely owing to the incidence of red rot disease, while Uba significantly outyielded the other six varieties on trial on the basis of yield of sugar cane per acre. In the multiplication of resistant new varieties whole canes were used for planting and not tips. Hot water treatment caused 90% of the buds on the canes to germinate—double that of untreated canes. An interesting observation on hot water treated canes at Maigana was that any canes contaminated with red rot showed the infection very rapidly after treatment. Treated canes were found to be more susceptible to termite attack.

Overhead Irrigation. F. ROMERO. *Azúcar*, 1956, **3**, (11), 25–30.—The various factors involved in designing a system of overhead irrigation are described, together with the advantages.

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Efficient Use of Sugar Cane Sprayers. J. L. SMILIE. *Sugar News* (Philippines), 1956, **32**, 606–607.—The reference in this paper, originally presented to the Annual Meeting of the American Society of Sugar Cane Technologists in 1956, is to tractor-drawn sprayers used to apply fertilizers in solution and herbicides. Cleanliness in maintenance, calibration and nozzle size, adjustment to cover the cane line and pump maintenance are subjects discussed.

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Pre-Harvest Spraying of 2,4-D. A. S. CHAKRAVARTI and K. L. KHANNA. *Indian J. Sugar Cane Res. Dev.*, 1957, **1**, 146–147.—Significant increases in purity of both crusher and mixed juice, in sugar % cane and in estimated recovery as the result of spraying 60 gal per acre 50 p.p.m. 2,4-D (sodium salt) were obtained in the 1955-56 season, thus confirming earlier results. The effect is apparent after two days and persists unabated till after 107 days.

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Some Suggestions for Improving Yield and Quality of Sugar Cane in Uttar Pradesh. R. K. TANDON *et al.* *Indian J. Agronomy*, 1956, **1**, 47–56.—The most important of the Provinces producing sugar in India is Uttar Pradesh with 58% of total Indian cane area, but in it yield per acre was only 18·4 tons in 1951–52. Though a big increase is shown over the figure of 12·9 tons for 1947–48, yield is still far below that of Bombay and Madras. One of the more important developments considered is varietal improvement, particularly in the direction of extension of the season with early and late maturing varieties. Emphasis is laid on the importance of adequate nitrogen, particularly in organic form as green manure to which a phosphate dressing has been given. There is scope for an intensified irrigation programme and ratooning capacity is becoming a varietal character of growing importance in view of the fact that ratoons now occupy some one-third of the total area under cane.

AN INTERESTING EXPERIMENT

THE determination of fertilizer requirements has been reduced to what amounts to a routine process in which two complementary methods are used. On the one hand there is soil analysis, by which the amounts of available nutrients are measured and any deficiencies disclosed made good; on the other there is the factorial field experiment. In the latter case, standard plot designs have been worked out from which, by the use of the latest statistical methods, the significance of the results is measured with great accuracy. It is well, in such cases, to turn back now and again and subject to detailed criticism all the procedural stages of the argument on which these routine methods are based. Only thus can it be assured that the argument is logical throughout and that results are not vitiated by failure to observe limitations either overlooked or disclosed by later work. The turn of the year is an appropriate season for such introspection.

One possible weakness in the experimental method is disclosed by such introspection; in the mass of reports of fertilizer experiments coming in from all over the world, how often is mention made of the pre-history of the experimental area ? Such a history is rarely, if ever, given in sufficient detail for any reader unacquainted with the local conditions to visualize the position; at most it may be briefly commented that the negative results obtained indicate that previous fertilizer treatment of the area has raised, it may be, the phosphate or the potash level to an adequate degree. Fertilizer experiments may be grouped into two classes: basic experiments, conducted on an experimental farm; and extension experiments, conducted on estate or farmers' land. The former, except in the case of newly opened stations, can have little land left that has never been the scene of some fertilizer experiment perhaps continuing to exert a residual effect. Similarly, there can be few areas among all but those where a primitive system of agriculture is still practised, where a fertilizer programme has not been in operation for a sufficient period to change materially the character of the soil. Behind the experiment itself and its interpretation there lies the assumption that it is this altered or artificial soil that forms the datum line, and not the original unfertilized soil. That assumption may or may not be justified, and here no dogmatic opinion is expressed on the point; but what is clear is that the whole problem of fertilization is a dynamic one and that any interpretation which treats it is a static problem carries within it an inherent weakness.

The three major plant nutrients which form the subject of most fertilizer experiments may all be lost to the soil by leaching, and a further loss, particularly of phosphorus, may result from fixation for a greater or shorter time; in the case of phosphorus and potassium there can be no gain except by direct application. The position with regard to nitrogen is entirely different; both gains and losses may occur through an interchange between soil and air, and such interchange is primarily biological, dependent on the organic status of the soil. That is only one of the functions served by humus, if an important one; there is also the physical rôle. The full story of humus has yet to be worked out and the details are not considered here; what is pertinent to the present argument is that the lowering of the organic status of the soil and, even more, the raising of that status, is a long-term process, for the investigation of which the normal short-term fertilizer experiment is not suitable. So long as the sole measure of acceptability of experimental data was the fulfilment of the rigid limitations imposed by statistics, the problem of the rôle of organic matter in the soil, which has been the subject of so much unnecessary acrimony in the past, seemed insoluble. A new approach to the subject was required and such an approach has been opened up by work at Haughley.

Haughley, situated in Essex, England, owes its existence to the energy and persistence of LADY EVE BALFOUR and the enthusiasm of a Miss DEBENHAM, whose two neighbouring farms became merged into the Haughley Estate. The history of its origin and development is to be found in a special issue (October 1946) of *The Journal of the Soil Association.* The work at Haughley commenced some eighteen years ago and, from the start, study was designed to centre on the rôle of organic matter as influencing soil fertility, the long-term nature of the problem was recognized and a unique approach worked out. The combined area was divided into three self-contained sections of 32, 75 and 75 acres, respectively. The smaller section is worked without stock, using only fertilizers supplemented by green manuring. The two remaining sections follow an eight-course rotation with 4-year leys and lucerne, and both carry a Guernsey herd. One of these, the organic section, is worked on an organic system with deep-rooting herbs in the leys, the composting of all farmyard manure and with mineral supplements supplied only through the stock in the form of dried seaweed. The other, the mixed section, is worked similarly but the manure is not composted, but applied fresh or rotted and supplemented by normal dressings of fertilizers. To secure maximum uniformity each farm was initially sown to the major crops with seed of identical source, but subsequently each section provides seed from its own produce. With the same objective, the two herds were derived from a few pairs of bulling heifers purchased from established Guernsey breeders, with each pair by the same sire and out of similar line-breeding. The same bull is used for both herds.

Development in the initial stages was deliberately slow owing to the necessity of eliminating any residual effects of pre-experimental manuring, and the war caused further delay. Only in 1948 was livestock added and not until 1952 was it possible to embark on a systematic programme of analyses both of the

soil and produce. This includes monthly analyses of the soils of the three sections and of the milk and eggs from the two stock-bearing sections. The feeding value of each section's produce, including vitamins and minerals, has also been determined. Five years' results only are available and one full rotation has yet to be completed, but already certain trends are plainly discernible[1]; of these, only a few can be mentioned here.

By contrast with a steady annual increase in humus content on the Organic section, there has been a steady fall on the Stockless section. On the Mixed section the humus content was, somewhat unexpectedly, barely maintained, although with the same return of organic matter. Noteworthy, too, is the seasonal variation found in the amounts of nitrogen, available potassium and, even more markedly, phosphorus. In the case of the Stockless and Mixed sections, where fertilizers have been applied, some of these variations are traceable to those applications. Such an explanation is not valid for the Organic section, in which these variations were most marked; here availability appears to be linked with soil humus. There are, of course, soils which are deficient in total phosphorus and potash, but, in the case of Haughley, the reserves in the top nine inches only are adequate for over 2000 and 3000 years respectively.

The justification of any cultural system lies in the quantity and quality of the produce. The Haughley experiment has not been continued long enough to yield results capable of strict statistical interpretation, but the trends are clear. The best comparison is that of milk, the major product of the Mixed and Organic sections. For these the comparative yields of milk/cow/year in 1956 were 741 and 856 gallons and of protein 332 and 377 lb. As common to all three sections, the weight (grams) per 100 grains of wheat may be taken as example: Stockless 3·20, Mixed 3·50, Organic 3·74.

There is every reason to believe that the results gradually emerging from the work at Haughley have a general application and will prove equally valid for tropical conditions, adjustments only having to be made for the speed of the reactions. On that, in large measure, depends the value and optimum method of use of such major organic residues of the sugar cane as trash and bagasse.

Attention is drawn here to the work at Haughley because it offers a new approach to the problems of soil fertility and its maintenance, and from the results valuable lessons may well emerge. But if the work is to continue, there remains the financial problem to be solved. Haughley is not only unique in its approach but in the fact that it has been entirely supported by the Soil Association, with a membership of some 4000 private individuals scattered around the world and by personal donations from some of these. For the last five years the annual cost has been some £7000, inclusive of all charges for analytical work; earlier this cost was some £1,000. Those are sums which sink into insignificance against the cost of established Institutions engaged in comparable studies. A wider financial basis must be established if the experiment is to be extended or even continued. The cane sugar industry is well situated to appreciate the dilemma, for it long ago set an example when both the Javan and Hawaiian industries took the responsibility of financing their own research. If the Javan industry is temporarily under a shadow, it led the world in yield of cane and sugar per acre. Its place has now been taken by Hawaii. The industries of most other cane-growing countries have followed the example of these two in that they at least bear the major financial load.

H.M.-L.

AGRICULTURAL ABSTRACTS

The Use of Sugar Cane as Fodder. A. J. González. *Mem. XXIX Conf. Asoc. Técn. Azuc. Cuba*, 1955, 45–51.—A discussion is given of the varieties of cane most suitable as sources of fodder with their nutrient value.

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Rainfall and Cane Yields in the French Antilles. H. Stehlé. *Rev. Agric. Sucr. Rhum. Antilles Franç.*, 1957, **2**, 3–7.—Figures drawn from the cultural trials at the Agricultural Research Centre, Guadeloupe, are listed; from these the dominating importance of rainfall in production is concluded. It is not easy to follow the argument since rainfall is measured in monthly totals and number of rainy days, the period covered is only two years, and the crops include plant cane to fifth ratoons of a large number of varieties.

Burnt Cane. J. Lizárraga G. *Mem. XXIX Conf. Asoc. Técn. Azuc. Cuba*, 1955, 53–59.—A series of analyses are given showing the increasing losses of sucrose and reduction in purity as the interval between burning and harvesting increases.

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Sugar Production in Uganda. *Uganda Dept. Agric. Ann. Rpt.*, 1956.—It is stated "The acreage of mature cane harvested on the two sugar estates was 16,684. The weather was again favourable and a mean yield of 4·13 tons/acre of plantation sugar was obtained. The total production amounted to 69,037 tons compared with 65,130 in 1955. Exports to Kenya and Tanganyika totalled 12,933 tons".

[1] *Mother Earth*, 1956, **9**, 657–700; 1957, **9**, 1009–1026.

Agricultural Abstracts

Improving Stands of Sugar Cane by Dipping Seed-Pieces into Fungicides. B. DANTAS and A. P. DE SILVA. *Bol. Tech. Inst. Agron. Nordeste* (Brazil), 1956, **4**, 18-45.—The relative improvement of stands through treating setts with a large range of organic fungicides is recorded.

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Germination of Sugar Cane Seed-Pieces as treated by Modern Organic Polychloric Insecticides. B. DANTAS *et al. Bol. Tech. Inst. Agron. Nordeste* (Brazil), 1956, **4**, 46–58.—This paper gives a record, similar to the last, of a range of insecticides. It is noted that these are more effective when applied to the cane setts in wet or emulsified form.

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Borer Index of Sugar Cane Varieties in Pernambuco. B. DANTAS *et al. Bol. Tech. Inst. Agron. Nordeste* (Brazil), 1956, **4**, 59-87.—The index chosen is one based on the % length of cane infected and is used to determine the relative resistance of a number of the important canes. The lowest infestation occurred in Co 331, Co 421, and the three IANE-C (locally bred canes) 46-162, 46-186 and 46-187.

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Ratooning Capacity and Ratoon Stunting of Sugar Cane. C. C. WANG. *Mem. Coll. Agric. Taiwan Univ.*, 1956, **4**, (2), 15–35 [Chinese]; through *Plant Breeding Abstracts*, 1957, 542.—Data are provided on the behaviour as a ratoon crop and the incidence of ratoon stunting in some of the more important varieties grown in Taiwan.

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Comparative Morphology of the Wild Sugar Canes in Japan Islands. A. MORIYA. *Jap. J. Breeding*, 1956, **6**, 122–125; through *Plant Breeding Abstracts*, 1957, 542.—A comparative morphological study of *S. spontaneum* from the Japanese mainland, the Ryukyu Islands and Taiwan is presented, particular attention being paid to the ligule. The samples from the Ryukyu Islands were markedly dissimilar to the other specimens.

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A New Disease of Sugar Cane in Pernambuco. B. DANTAS. *Bol. Tech. Inst. Agron. Nordeste* (Brazil), 1956, **4**, 3–17.—This disease, first reported in 1954 and tentatively named foliar yellow-striped disease, has symptoms somewhat similar to leaf scald. The paper records observations of varietal susceptibility and notes that the standard hot water treatment of 52°C for 20 minutes is effective. Its true nature has not yet been determined.

Ratoon Stunting Disease. A. L. FORS. *Mem. XXIX Conf. Asoc. Técn. Azuc. Cuba*, 1955, 41–44.—The nature, symptoms, methods of transmission and control of the disease are briefly noted.

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Drainage in the Imperial Valley, California. C. LOAYZA G. *Azúcar*, 1956, **3**, (11), 56–63.—A description of the methods used in reclamation of water-logged areas through drainage.

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The Principal Insects attacking Sugar Cane. S. H. RISCO B. *Azúcar*, 1956, **3**, (11), 41–55.—Fourteen insects are listed and described in some detail, together with the parasites of each offering the means for biological control.

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Factors Overlooked in Harvesting Cane. A. L. FORS. *Mem. XXIX Conf. Asoc. Técn. Azuc. Cuba*, 1955, 37–40.—The loss of cane and sugar in both plant and ratoon crops, resulting from cutting cane too high (leaving 7 inches of stem) is shown to be considerable.

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Injurious Plants in the Canefields. A. J. GONZÁLEZ. *Mem. XXIX Conf. Asoc. Técn. Azuc. Cuba*, 1955, 27–36.—The modes of establishment of injurious plants, usually called weeds, are discussed and illustrated by specific examples, and the paper ends with a long list of plants characterized as undesirable.

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Biological Control of the Borer in the Valley of Pativilca. S. H. RISCO B. *Azúcar*, 1956, **3**, (11), 31–40.—For reasons undetermined, the population of indigenous *Paratheresia claripalpis* had by 1951 undergone a serious reduction with a consequent increase in damage by borer. As the result of breeding and liberating this fly since 1952, borer infestation has, on average, been reduced from 28% to 17%.

* * *

Comparative Studies of New Varieties. R. BARRETO D. *Mem. XXIX Conf. Asoc. Técn. Azuc. Cuba*, 1955, 17–25.—The results here recorded are of a series of trials conducted on five estates in association with the Jovellanos Sugar Experiment Station. They refer to the first ratoon crop, the results of the plant crop having been reported to the 28th Conference.[1] The striking feature is the change in the relative order of the varieties when listed according to yield of sugar per unit area. Final estimation of value must, therefore, await the results of the second ratoon crop.

[1] *I.S.J.*, 1956, **58**, 296.

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SEPARATION AND ESTIMATION OF SUGARS IN CANE PRODUCTS

By D. H. FOSTER and G. H. MARSH

THERE are many applications in sugar technology for a reliable method of estimating glucose and fructose in the presence of other plant substances. One application of considerable interest occurs in studies of the effects of glucose and fructose on sucrose crystallization.

A technique using selective oxidation of glucose with alkaline iodine solution followed by determination of fructose with the modified Luff-Schoorl method has been described by KELLY[1]. In applying this method to molasses analyses, two problems arose. At lower temperatures (18°C) the alkaline iodine oxidation proceeded at a manageable rate. However, at temperatures of 27–29°C, the reaction time was so short that it was impossible to carry out the analysis with the care required for precise work. Change in rate with temperature was so great that the method had to be calibrated for each degree change in temperature. Secondly, it was suspected that other reducing substances (including sugars) in the molasses might affect the results.

The following method employing separation of sugars on paper chromatograms was developed to check results obtained by oxidation methods.

Experimental Method

Filter paper circles (Whatman No. 3, 38 cm dia) were washed with 0·5–1·0% ammonia solution, dropped on to the centre of the paper which was held between the body and lid of a desiccator[2]. The paper was dried in an air oven at 40°C and the solution for analysis was applied to the centre of the paper from a micropipette. A solution containing about 17 g of sugar per 100 ml was used and the pipette delivered about 0·1 ml with an accuracy of ±0·0007 ml. A number of applications, between each of which the paper was dried, prevented the spot from spreading to more than 1 cm in diameter. A wick was then introduced through the centre of the spot and allowed to dip into the solvent. The paper was again supported as described, in a large desiccator. The solvent used was butanol, glacial acetic acid and water, in the proportion of 4:1:1 by volume. Separation of glucose and fructose was found to be better at temperatures below 20°C; therefore, in hot weather the chromatography tanks were placed in the refrigerator at approximately 8°C, and the solvent was allowed to run for periods up to 48 hours. (If the diameter of the paper is slightly larger than the diameter of the desiccator, slow evaporation can take place from the edge of the paper and, in effect, a longer run is obtained. This is more successful than multiple development).

The papers were then dried in a draught of air. Twelve equally separated segments each of 2° were marked, labelled, and cut out. These segments were then sprayed with *p*-anisidine phosphate in ethanol solution[3] and baked in an oven for 3–5 minutes at 95–100°C. Fructose shows as a yellow band, glucose as a light brown and sucrose as a yellowish brown band. Positions of the sugars on the remaining segments were marked and bands containing them were cut out and eluted with water at 40°C. The solution was filtered into a volumetric flask through button filters which were packed under vacuum with glass wool and then "Supercel". The solutions were made up to a known volume and analysed by development of colour with anthrone in sulphuric acid, the intensity of the colour produced at 625mμ being read on a spectrophotometer, as described by JOHANSON[4]. Tropic conditions demand the cooling

[1] *J. Applied Chem.*, 1954, **4**, 622.
[2] DUBOIS *et al.*: *Anal. Chem.*, 1956, **28**, 350.
[3] GARDNER: *Nature*, 1955, **176**, 929.
[4] *Anal. Chem.*, 1954, **26**, 1331.

Table I. Recovery of Sugars from Synthetic Solutions.

Amount of Sugar applied to paper (mg)				Amount of Sugars recovered (mg)				% Sugars recovered		
Sucrose	Glucose	Fructose	Total	Sucrose	Glucose	Fructose		Sucrose	Glucose	Fructose
13·32	2·69	3·60	19·61	13·40	2·80	3·61		100·5	104·0	100·3
				13·24	2·87	3·42		99·3	106·5	95·0
13·32	2·66	3·55	19·53	13·57	2·57	3·67		101·8	96·5	103·4
				13·57	2·65	3·74		101·8	99·7	105·9
13·32	2·66	3·56	19·94	13·52	2·51	3·89		101·5	94·2	109·4
13·33	2·67	3·62	19·62	13·70	2·63	3·80		102·7	98·7	105·1
13·33	2·66	3·56	19·55	13·38	2·67	3·51		100·4	100·2	98·5
13·20	2·64	3·53	19·37	13·29	2·55	3·76		100·7	96·6	106·4
13·32	2·66	3·58	19·56	13·27	2·60	3·53		99·6	97·5	98·7
13·32	2·66	3·56	19·54	13·28	2·50	3·74		99·7	92·5	105·1
				Mean Recovery				100·8	98·6	102·8
				Standard Deviation of Single Estimation				1·12	4·23	4·47

of sugar and anthrone solutions prior to mixing, otherwise the two liquids react at the interface while still spinning, and unreliable results are obtained. A correction factor for the amount of paper cut out for spraying was employed. Blank estimations were also made on paper previously washed with ammonia and solvent.

Synthetic mixtures of sucrose, glucose and fructose, in proportions similar to those found in molasses, were made up and analysed, to give the results shown in Table I.

Application to Sugar Cane Products

A great advantage of the method was the fact that no preliminary clarification of solutions was required to give good separation of the sugars. Test were carried out to check the interference due to other substances which occur in molasses and which may have R_f values similar to any of the sugars. The effect of these substances on the spectrophotometer reading is shown in Table II.

Table II. Effect of Non-Sugars on Anthrone Method.

Concn. of sugar γ/3 ml	Impurity	Concn. of impurity γ/3 ml	Concn. of impurity in diluted molasses proportional to 150γ sugar/3 ml	% Transmission
150	—	—	—	19·1
150	Mg^{++} ($MgCl_2$)	21	5	19·1
150	Ca^{++} ($CaCl_2$)	24	5	18·9
150	PO_4^{---} (Na_2HPO_4)	12	2	19·3
150	SO_4^{--} (K_2SO_4)	30	7	19·2
150	K^+ (KCl)	150	15	18·9
150	Aspartic Acid	3	—	19·1

Since a reading of 0·1% transmission on the spectrophotometer is equivalent to 0·5γ of sugar in the range of 150γ, in which the majority of readings were taken, and since most of the impurities tested were far in excess of the quantities occurring in molasses, interference is considered to be zero or negligible.

A most interesting feature of the tests on molasses was the separation of two sugars other than sucrose, glucose and fructose. In the solvent system used the R_G values* were as follows:—

Unknown 1	0·60
Sucrose	0·80
Fructose	1·12
Unknown 2	1·27

$$* R_G = \frac{R_f \text{ sugar}}{R_f \text{ glucose}}$$

Both sugars contained ketose units since they gave positive colour reactions with ketose specific sprays. In all probability they are fructose-anhydrides such as were found by SATTLER and ZERBAN[5], and/or psicose which has been found in distillery waste by the same authors[6].

Comparative analyses of molasses samples from different Queensland mills by KELLY'S oxidation method and by chromatography gave the results shown in Table III. The values shown for the two unknown sugars were obtained by assuming that their colour development with anthrone would be similar to that given by an equal weight of fructose. The principal difference between the two methods lies in the values obtained for fructose. These were much lower when the chromatography technique was used, and resulted in higher glucose-fructose ratios.

Cane juice was also analysed for sucrose by the above method and the result was compared with the polariscope and oxidation methods. The results appear below.

Table IV. Analysis of Cane Juice.

Chromatography : Sucrose	Glucose	Fructose	Sucrose by acid inversion and Lane & Eynon sugar estimation	Pol	Pol calculated from chromatographic results
18·7	—	—	—	18·45	—
18·6	0·182	0·187	18·68	18·54	18·5
18·6	0·200	0·193			

Conclusions

A method has been developed by which sucrose, glucose and fructose from cane products can be separated quantitatively by paper chromatography. The standard deviation for a single estimation of sucrose was 1·12%, when 13 mg were applied to the paper. Selective oxidation techniques have proved to be unreliable for estimating fructose in molasses owing to the presence of other keto sugars.

[5] *Ind. Eng. Chem.*, 1945, **37**, 1133.
[6] *Ibid.*, 1942, **34**, 1180.

Table III. Constituent Sugars of Various Queensland Molasses (%)

Mill		Sucrose	Glucose	Fructose	G/F	Unknown 1	Unknown 2	Glucose and Fructose	Glucose and Fructose and Unk owns
A		A*34·7	5·01	7·29	0·69	1·10	0·54	12·30	13·94
		B 35·9	5·26	10·52	0·499	—	—	15·78	—
B		A 34·75	5·73	6·91	0·83	1·28	0·46	12·64	14·38
		B 37·37	4·91	8·99	0·546	—	—	13·90	—
C		A 31·8	6·12	7·31	0·837	0·828	0·54	13·43	14·80
		B 33·0	6·89	9·27	0·743	—	—	16·16	—
D		A 34·7	3·97	6·30	0·63	0·73	0·49	10·27	11·49
		B 35·95	3·91	8·46	0·462	—	—	12·37	—

* A = Chromatographic method. B = Oxidation method.

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AN INSTRUMENT FOR CONCENTRATION OR SUPERSATURATION RECORDING

Of Boiling Sugar Solutions*

By G. V. GENIE, Dr.Sc. (Raffinerie Tirlemontoise S.A., Tirlemont, Belgium)

PART II

Bridge Design

The simple circuit shown in Fig. 1 is inconvenient for practical use and, for reasons that will appear below, the more elaborate circuit shown in Fig. 4 must be preferred. In this circuit each thermistor is mounted in series with a resistor of constant value R_1. The two other legs of the bridge are two resistors of equal resistance R_2 and a resistor r is connected across the bridge.

. . . . . .

Mathematics of the bridge operation are here omitted but may be obtained in full from the author on request.

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Influence of Purity

Heretofore only pure sucrose solutions have been considered, but most solutions processed in sugar manufacture contain impurities from either beet or cane, and the measuring device must be designed to work with solutions of any purity between 100% (pure sucrose) and 70%. Much difficulty arises from the fact that the nature of the impurities influences the boiling point elevation of a sugar solution which, for instance, might not be the same for beet and cane sugar, and also that few experimental data are available.

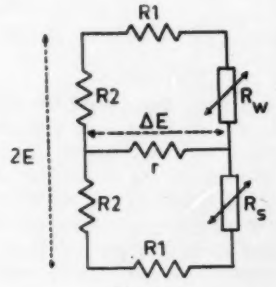

Fig. 4.

The ratio of the difference $1/T_w - 1/T_s$ for an impure solution to the difference $1/T_w' - 1/T_s$ for a pure solution of the same concentration (in solids) at the same temperature has been calculated from Spengler's work[4] and is hereafter called k_P.

As the experimental determinations of Spengler for concentrated solutions were made at random concentrations, corresponding values for a pure solution are not directly available and must be interpolated for both temperature and concentration. To avoid that difficulty, Spengler's own (graphically) interpolated table ([4], Table 13) has been used. The values of k_P which appear in Table V show that k_P depends mainly on purity, and that it can be considered as roughly constant with respect to concentration and temperature for solutions between 65% and 85%.

Table V

Value of k_P from Spengler's data

C / p	45	55	65	75	80	85	90
			Purity 90				
0·25 ..	1·13	1·11	1·08	1·07	1·06	—	—
0·50 ..	1·14	1·13	1·10	1·07	1·08	—	—
0·75 ..	1·15	1·14	1·11	1·08	1·10	—	—
1·00 ..	1·15	1·14	1·11	1·08	1·10	1·09	1·06
1·25 ..	1·16	1·15	1·12	1·09	1·10	1·09	1·06
1·50 ..	1·16	1·15	1·12	1·09	1·10	1·09	1·07
1·75 ..	1·17	1·15	1·12	1·10	1·11	1·09	1·06
2·00 ..	1·15	1·16	1·12	1·10	1·11	1·10	1·08
2·50 ..	1·16	1·16	1·11	1·10	1·12	1·11	—
			Purity 80				
0·25 ..	1·31	1·29	1·24	1·20	1·19	—	—
0·50 ..	1·36	1·33	1·25	1·20	1·22	—	—
0·75 ..	1·36	1·35	1·27	1·21	1·24	—	—
1·00 ..	1·37	1·36	1·27	1·21	1·24	1·22	1·16
1·25 ..	1·38	1·37	1·27	1·23	1·25	1·22	1·16
1·50 ..	1·39	1·37	1·27	1·23	1·25	1·22	1·16
1·75 ..	1·40	1·38	1·27	1·23	1·26	1·22	1·16
2·00 ..	1·41	1·37	1·27	1·24	1·27	1·24	1·18
2·50 ..	1·42	1·39	1·27	1·24	1·29	1·26	—
			Purity 70				
0·25 ..	1·56	1·53	1·43	1·36	1·35	—	—
0·50 ..	1·60	1·55	1·44	1·36	1·39	—	—
0·75 ..	1·63	1·59	1·44	1·37	1·42	—	—
1·00 ..	1·67	1·62	1·46	1·38	1·42	1·40	1·28
1·25 ..	1·69	1·63	1·47	1·40	1·42	1·40	1·29
1·50 ..	1·71	1·65	1·47	1·40	1·43	1·39	1·30
1·75 ..	1·72	1·67	1·47	1·40	1·43	1·39	1·29
2·00 ..	1·73	1·67	1·46	1·40	1·46	1·42	1·32
2·50 ..	1·74	1·69	1·46	1·41	1·48	1·46	—

This result was, however, checked with Spengler's true experimental values for atmospheric pressure, the corresponding values for pure sucrose being linearly interpolated with respect to concentration (g sucrose/g water) between two adjacent determinations. These values are plotted against concentration (g solids/g water) in Fig. 5. The diagram shows a maximum at concentration 1 and a slow decrease of the factor k_P with increasing concentration. However, in the range 2·5–6·0 (which is the most important for industrial purposes), k_P can be considered as constant, and the following values have been adopted:—

Purity		k_P
100	.....	1 (by definition)
95	.....	1·04
90	.....	1·10
85	.....	1·17
80	.....	1·25
75	.....	1·33
70	.....	1·42

It is possible to extend the theory included in the first section to impure solutions.

$$\text{As } \left(\frac{1}{T_w}-\frac{1}{T_s}\right)_P = k_P\left(\frac{1}{T_w}-\frac{1}{T_s}\right)_{100} = k_P f(C)$$

$$\text{and } \ln\frac{R_w}{R_s} = b\left(\frac{1}{T_w}-\frac{1}{T_s}\right)_P = k_P b\, f(C)$$

$$\text{we have } \frac{\Delta E}{E} = \frac{R_w - R_s}{R_w + R_s} = \frac{1}{2}\ln\frac{R_w}{R_s} = k_P\frac{b}{2}f(C)$$

$$\text{or } \frac{\Delta E}{k_P E} = \frac{b}{2}f(C) \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (19)$$

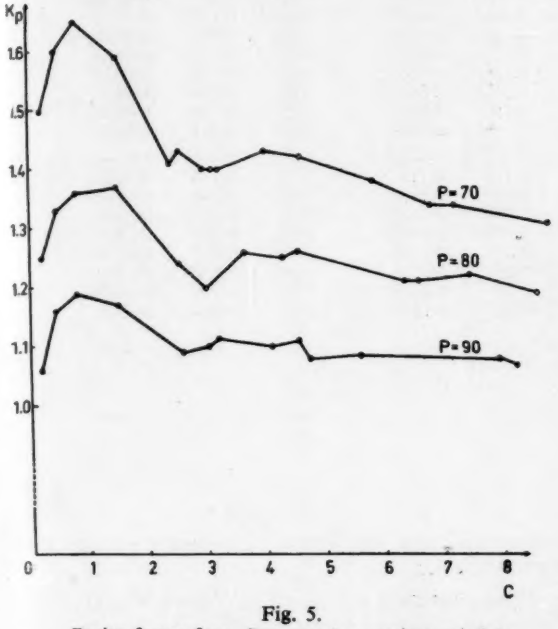

Fig. 5.
Purity factor from SPENGLER's experimental data.

The measuring instrument can thus be adapted to sugar solutions of any purity, simply by decreasing the difference of potential across the bridge, so that the product $k_P E$ should remain constant. If R_2 is small compared to the resistance of the thermistors, the total current drain through the bridge is constant, and this decrease can be achieved by mounting a potentiometer in series with the bridge. It is convenient to graduate this potentiometer directly in purity.

As the two thermistors may not have exactly the same resistance at the same temperature, another potentiometer of small resistance must be mounted between the two resistors R_2 of the bridge.

This potentiometer is called "zero potentiometer" and is adjusted so that the instrument reading is zero when pure water is boiled.

The final shape of the bridge is shown in Fig. 6.

SUPERSATURATION MEASUREMENTS

When crystals are to be obtained from a boiling sucrose solution, the supersaturation coefficient of the solution is more important to know than its concentration, as the crystallization velocity is influenced by the supersaturation of the solution.

The supersaturation coefficient S is usually defined as the ratio of the actual sucrose concentration C of the solution to the concentration C_s of a saturated solution at the same temperature, both concentrations being expressed in grams sucrose per gram water.

$$S = \frac{C}{C_s} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (20)$$

For impure solutions the two should have the same composition and the concentrations should be expressed in grams solids per gram water.

As the solubility of sucrose increases when the temperature increases, a solution of constant concentration can be supersaturated at low temperature and undersaturated at high temperature, i.e. the supersaturation coefficient S decreases when the temperature of the solution increases.

Considering equation (16)* where K is about constant at constant concentration, $\Delta E/E$ can be made proportional to S provided the denominator is made proportional to C_s, i.e. increasing when the temperature increases. This can be done by taking a large value for R_1. Of course, the agreement can only be approximate, but it is still adequate for industrial purposes.

Although many determinations have been made, little reliable information is available on the concentration of saturated sugar solutions, especially impure.

A critical review of the previous literature for impure solutions is given by GRUT[9] and a comparative table for pure sucrose solutions by HRUBY.[10] These papers show discrepancies which, for impure solutions, may be assigned to the influence of the composition of the impurities on the solubility of

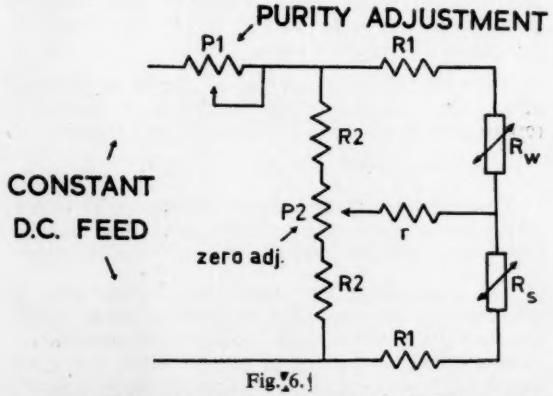

Fig. 6.

sucrose. This influence is important and GRUT states that it is impossible to give an accurate general figure for the solubility of sucrose in low-purity syrups. The table published by him for impure solutions, which will be used in this paper, must be considered as an average figure for beet sugar solutions.

[9] *Z. Zuckerind. Czechoslov. Rep.*, 1937, **61**, 345–351, 356–359, 373–375.
[10] *Z. Zuckerind. Czechoslov Rep.*, 1939, **63**, 187–194.

Table VI

Supersaturation measuring circuit for pure sucrose solutions according to DUNNING's and TAYLOR's data when $b = 4478°K$ and $R_1/R_{80} = 1·2$

t_s	$S = 0·2$			$S = 0·4$			$S = 0·6$		
	C	K	$\Delta E/E$	C	K	$\Delta E/E$	C	K	$\Delta E/E$
60	0·57	0·015	0·0097	1·15	0·033	0·0214	1·72	0·054	0·0353
65	0·61	0·016	0·0096	1·22	0·035	0·0211	1·82	0·057	0·0347
70	0·65	0·017	0·0094	1·30	0·038	0·0211	1·94	0·062	0·0349
75	0·69	0·018	0·0091	1·38	0·041	0·0209	2·08	0·067	0·0347
80	0·74	0·020	0·0092	1·49	0·045	0·0210	2·23	0·073	0·0346
85	0·80	0·022	0·0092	1·61	0·049	0·0207	2·41	0·080	0·0345
90	0·87	0·024	0·0090	1·74	0·054	0·0207	2·62	0·089	0·0349
95	0·95	0·027	0·0091	1·91	0·060	0·0208	2·86	0·098	0·0348
	$S = 0·8$			$S = 1·0$			$S = 1·2$		
60	2·30	0·076	0·0501	2·87	0·099	0·0658	3·44	0·123	0·0824
65	2·43	0·081	0·0498	3·04	0·106	0·0658	3·65	0·131	0·0822
70	2·59	0·088	0·0501	3·24	0·114	0·0657	3·89	0·141	0·0824
75	2·77	0·095	0·0499	3·46	0·123	0·0655	4·15	0·152	0·0823
80	2·98	0·103	0·0496	3·72	0·134	0·0657	4·46	0·165	0·0824
85	3·22	0·113	0·0498	4·02	0·146	0·0657	4·82	0·179	0·0823
90	3·49	0·124	0·0498	4·36	0·160	0·0659	5·23	0·196	0·0828
95	3·82	0·137	0·0501	4·77	0·176	0·0662	5·72	0·215	0·0834
	$S = 1·4$			$S = 1·6$			$S = 1·8$		
60	4·02	0·147	0·0995	4·59	0·172	0·1175	5·17	0·196	0·1351
65	4·26	0·157	0·0996	4·86	0·183	0·1174	5·47	0·209	0·1356
70	4·54	0·168	0·0994	5·18	0·195	0·1169	5·83	0·223	0·1356
75	4·84	0·181	0·0995	5·54	0·210	0·1173	6·23	0·240	0·1364
80	5·21	0·196	0·0997	5·95	0·227	0·1177	6·70	0·257	0·1358
85	5·63	0·213	0·1001	6·43	0·245	0·1177	7·24	0·277	0·1361
90	6·10	0·232	0·1006	6·98	0·266	0·1183	7·85	0·299	0·1363
95	6·68	0·254	0·1016	7·63	0·289	0·1189	8·59	0·324	0·1373
	$S = 2·0$								
60	5·74	0·221	0·1538						
65	6·08	0·234	0·1535						
70	6·48	0·250	0·1541						
75	6·92	0·267	0·1541						
80	7·44	0·286	0·1540						
85	8·04	0·307	0·1541						
90	8·72	0·331	0·1547						
95	9·54	0·357	0·1556						

For sucrose solutions, HERZFELD's table[11] has long been considered as the official table in the sugar industry. GRUT and HRUBY, however, have observed a slight error between 50 and 80°C, and GRUT has published a corrected table.[9]

More recently, TAYLOR[12] after careful experimentation, has shown that the solubility of sucrose is represented up to 82°C by the empirical equation:—

$$C_s = 63·608 + 0·1322\ t + 0·000722\ t^2$$

This equation gives between 60 and 80°C values, which are between those of HERZFELD and those of GRUT, and will be adopted here for pure solutions.

The supersaturation measuring bridge can be calculated in the following manner: a table is constructed giving for various temperatures the concentration of the solution (in grams solids per gram water) for supersaturation coefficients up to 2 in 0·2 steps, and for each concentration the factor K is calculated by interpolation of Table III* or directly from equation (6). The value of the compensation resistor R_1 can be calculated exactly in the same way as for a concentration bridge from two particular values of K.

The value of $\Delta E/E$ is then computed from equations (16)* or (18)* according to the kind of bridge used, and checked for constancy at constant supersaturation.

Three examples are given in Tables VI, VII and VIII.

Table VI is constructed from DUNNING's data[6] for boiling point elevation and TAYLOR's data for the solubility of sucrose[12]. TAYLOR's empirical formula had to be extrapolated up to 95°C. The bridge is of the "open" type, i.e. with r infinite. The values of K were determined by graphical interpolation of Table III.* The value of R_1/R_{80} was calculated according to equation (17)* for various temperatures and supersaturations, and the mean value $R_1/R_{80} = 1·20$ was adopted as giving the best agreement for supersaturation coefficients from 1·0 to 1·4 between 60 and 80°C, which represents the usual working range of the instrument. The constancy of $\Delta E/E$ is remarkable, $\pm 1\%$ except for low concentrations, i.e. the precision attainable in the interpolation.

Table VII, which is intended for impure solutions, is constructed on equation (6) for the boiling point elevation, GRUT's data[9] for concentration of satur-

[11] *Z. Ver. deut. Zuckerind.*, 1892, **42**, 181.

[12] *J. Chem. Soc.*, 1947, 1678–1683.

* Tables II to IV and equations (11) to (18) appear in the mathematical section omitted from this paper.

Table VII

Supersaturation measuring circuit according to GRUT's data and equation (6) when $b = 4478°K$ and $R_1/R_{80} = 1·2$

P $(1/k_P')$	t_s	$S = 0·2$ C	K	$\Delta E/E$	$\Delta E/k_P'E$	$S = 0·4$ C	K	$\Delta E/E$	$\Delta E/k_P'E$
100	60 ..	0·59	0·015	0·0099	0·0099	1·17	0·034	0·022	0·022
	70 ..	0·66	0·018	0·0098	0·0098	1·32	0·039	0·022	0·022
(1)	80 ..	0·76	0·021	0·0096	0·0096	1·52	0·047	0·022	0·022
95	60 ..	0·57	0·016	0·0101	0·0099	1·15	0·035	0·022	0·022
	70 ..	0·65	0·018	0·0100	0·0098	1·30	0·040	0·022	0·022
(0·980)	80 ..	0·75	0·021	0·0098	0·0096	1·50	0·048	0·022	0·022
90	60 ..	0·57	0·016	0·0106	0·0099	1·14	0·036	0·023	0·022
	70 ..	0·64	0·019	0·0105	0·0098	1·29	0·042	0·023	0·022
(0·934)	80 ..	0·74	0·022	0·0104	0·0097	1·49	0·050	0·023	0·022
85	60 ..	0·57	0·017	0·0112	0·0098	1·13	0·038	0·025	0·022
	70 ..	0·64	0·020	0·0111	0·0097	1·29	0·045	0·025	0·022
(0·875)	80 ..	0·75	0·024	0·0111	0·0097	1·49	0·053	0·025	0·022
80	60 ..	0·58	0·019	0·0122	0·0097	1·15	0·042	0·027	0·022
	70 ..	0·65	0·022	0·0121	0·0096	1·31	0·049	0·027	0·022
(0·795)	80 ..	0·77	0·026	0·0122	0·0097	1·53	0·059	0·028	0·022
75	60 ..	0·60	0·021	0·0135	0·0095	1·19	0·046	0·030	0·021
	70 ..	0·68	0·024	0·0135	0·0095	1·36	0·054	0·030	0·021
(0·703)	80 ..	0·82	0·030	0·0140	0·0098	1·63	0·067	0·032	0·022
70	60 ..	0·63	0·024	0·0154	0·0092	1·26	0·053	0·035	0·021
	70 ..	0·72	0·028	0·0155	0·0093	1·45	0·062	0·035	0·021
(0·597)	80 ..	0·90	0·036	0·0167	0·0100	1·80	0·081	0·038	0·023
		$S = 0·6$				$S = 0·8$			
100	60 ..	1·76	0·055	0·036	0·036	2·34	0·078	0·051	0·051
	70 ..	1·99	0·064	0·036	0·036	2·65	0·090	0·051	0·051
	80 ..	2·28	0·075	0·036	0·036	3·04	0·106	0·051	0·051
95	60 ..	1·72	0·056	0·037	0·036	2·30	0·079	0·052	0·051
	70 ..	1·96	0·065	0·037	0·036	2·61	0·092	0·052	0·051
	80 ..	2·24	0·077	0·037	0·036	2·99	0·108	0·052	0·051
90	60 ..	1·70	0·058	0·038	0·036	2·27	0·082	0·054	0·051
	70 ..	1·93	0·068	0·038	0·036	2·58	0·096	0·055	0·051
	80 ..	2·23	0·081	0·038	0·036	2·98	0·114	0·055	0·051
85	60 ..	1·70	0·062	0·041	0·035	2·26	0·087	0·058	0·051
	70 ..	1·93	0·072	0·041	0·036	2·58	0·102	0·058	0·051
	80 ..	2·24	0·086	0·041	0·036	2·98	0·121	0·059	0·052
80	60 ..	1·73	0·067	0·044	0·035	2·30	0·095	0·063	0·050
	70 ..	1·96	0·079	0·045	0·035	2·62	0·111	0·064	0·051
	80 ..	2·30	0·095	0·046	0·036	3·06	0·134	0·066	0·052
75	60 ..	1·79	0·075	0·049	0·035	2·38	0·105	0·070	0·049
	70 ..	2·04	0·088	0·050	0·035	2·72	0·123	0·071	0·050
	80 ..	2·45	0·109	0·053	0·037	3·26	0·153	0·076	0·053
70	60 ..	1·90	0·086	0·057	0·034	2·53	0·121	0·081	0·048
	70 ..	2·17	0·101	0·058	0·034	2·90	0·142	0·083	0·049
	80 ..	2·70	0·131	0·064	0·038	3·60	0·183	0·092	0·055
		$S = 1·0$				$S = 1·2$			
100	60 ..	2·93	0·102	0·068	0·068	3·52	0·126	0·085	0·085
	70 ..	3·31	0·117	0·068	0·068	3·97	0·145	0·085	0·085
	80 ..	3·80	0·138	0·068	0·068	4·56	0·170	0·085	0·085
95	60 ..	2·87	0·103	0·069	0·067	3·44	0·128	0·086	0·084
	70 ..	3·26	0·120	0·069	0·068	3·91	0·148	0·087	0·085
	80 ..	3·74	0·141	0·069	0·068	4·49	0·173	0·087	0·085
90	60 ..	2·84	0·108	0·072	0·067	3·41	0·134	0·090	0·084
	70 ..	3·22	0·125	0·072	0·068	3·86	0·155	0·091	0·085
	80 ..	3·72	0·148	0·073	0·068	4·46	0·182	0·092	0·086
85	60 ..	2·83	0·114	0·076	0·067	3·40	0·142	0·096	0·084
	70 ..	3·22	0·133	0·077	0·068	3·86	0·164	0·097	0·085
	80 ..	3·73	0·157	0·078	0·069	4·48	0·194	0·099	0·086
80	60 ..	2·88	0·124	0·083	0·066	3·46	0·154	0·105	0·083
	70 ..	3·27	0·144	0·084	0·067	3·92	0·178	0·106	0·084
	80 ..	3·83	0·173	0·087	0·069	4·60	0·213	0·110	0·087
75	60 ..	2·98	0·138	0·093	0·065	3·58	0·171	0·117	0·082
	70 ..	3·40	0·161	0·095	0·067	4·08	0·198	0·119	0·084
	80 ..	4·08	0·198	0·101	0·071	4·90	0·243	0·127	0·089
70	60 ..	3·16	0·157	0·107	0·064	3·79	0·195	0·134	0·080
	70 ..	3·62	0·184	0·110	0·066	4·34	0·227	0·138	0·083
	80 ..	4·50	0·235	0·123	0·073	5·40	0·287	0·155	0·092

Table VII (*continued*)

P ($1/k_P'$)	t_s	$S = 1{\cdot}4$ C	K	$\Delta E/E$	$\Delta E/k_P'E$	$S = 1{\cdot}6$ C	K	$\Delta E/E$	$\Delta E/k_P'E$
100	60	4·10	0·151	0·103	0·103	4·69	0·176	0·121	0·121
	70	4·63	0·173	0·103	0·103	5·30	0·201	0·121	0·121
	80	5·32	0·202	0·103	0·103	6·08	0·233	0·121	0·121
95	60	4·02	0·154	0·104	0·102	4·59	0·179	0·123	0·120
	70	4·56	0·177	0·105	0·103	5·22	0·206	0·124	0·122
	80	5·24	0·206	0·105	0·103	5·98	0·238	0·124	0·122
90	60	3·98	0·160	0·109	0·102	4·54	0·187	0·128	0·120
	70	4·51	0·185	0·110	0·103	5·15	0·214	0·130	0·121
	80	5·21	0·216	0·111	0·104	5·95	0·250	0·131	0·123
85	60	3·96	0·170	0·116	0·101	4·53	0·198	0·136	0·119
	70	4·51	0·196	0·118	0·103	5·15	0·227	0·139	0·121
	80	5·22	0·230	0·120	0·105	5·97	0·266	0·141	0·123
80	60	4·03	0·185	0·127	0·101	4·61	0·215	0·149	0·119
	70	4·58	0·213	0·129	0·102	5·23	0·247	0·152	0·121
	80	5·36	0·252	0·133	0·106	6·13	0·291	0·157	0·125
75	60	4·17	0·204	0·141	0·099	4·77	0·237	0·166	0·117
	70	4·76	0·236	0·144	0·102	5·44	0·273	0·170	0·120
	80	5·71	0·286	0·154	0·108	6·53	0·328	0·182	0·128
70	60	4·42	0·232	0·162	0·097	5·06	0·270	0·191	0·114
	70	5·07	0·269	0·167	0·100	5·79	0·310	0·197	0·118
	80	6·30	0·337	0·187	0·112	7·20	0·383	0·220	0·132
		$S = 1{\cdot}8$				$S = 2{\cdot}0$			
100	60	5·27	0·201	0·139	0·139	5·86	0·226	0·158	0·158
	70	5·96	0·229	0·140	0·140	6·62	0·256	0·158	0·158
	80	6·84	0·263	0·140	0·140	7·60	0·292	0·158	0·158
95	60	5·17	0·205	0·142	0·139	5·74	0·230	0·161	0·157
	70	5·87	0·234	0·143	0·140	6·52	0·261	0·162	0·159
	80	6·73	0·269	0·143	0·140	7·48	0·299	0·162	0·159
90	60	5·11	0·214	0·148	0·139	5·68	0·240	0·168	0·157
	70	5·80	0·244	0·150	0·140	6·44	0·272	0·170	0·158
	80	6·70	0·282	0·151	0·142	7·44	0·313	0·172	0·160
85	60	5·09	0·226	0·157	0·138	5·66	0·253	0·179	0·156
	70	5·80	0·258	0·160	0·140	6·44	0·289	0·181	0·159
	80	6·71	0·300	0·163	0·143	7·46	0·332	0·185	0·162
80	60	5·18	0·245	0·172	0·137	5·76	0·275	0·196	0·155
	70	5·89	0·280	0·175	0·139	6·54	0·312	0·199	0·158
	80	6·89	0·327	0·181	0·144	7·66	0·362	0·205	0·163
75	60	5·36	0·270	0·192	0·135	5·96	0·302	0·217	0·153
	70	6·12	0·309	0·196	0·138	6·80	0·343	0·222	0·156
	80	7·34	0·368	0·209	0·147	8·16	0·406	0·237	0·167
70	60	5·69	0·306	0·220	0·131	6·32	0·341	0·249	0·149
	70	6·52	0·350	0·227	0·136	7·24	0·387	0·257	0·153
	80	8·10	0·427	0·253	0·151	9·00	0·468	0·285	0·170

ated solutions and the assumption that k_P is constant. As this is only approximately true for concentrations within the working range of the instrument, the precision attained for impure solutions will be lower than for pure solutions. This is of little importance, since, as previously stated, the data for impure solutions on which the calculations are based are unreliable on account of the variable composition of the impurities.

The purity correction can be made by either decreasing the voltage applied to the bridge or by increasing R_1/R_{80} or even both. Since the increasing of R_1/R_{80} needs a twin-potentiometer with perfect symmetry, the first system is preferred. The bridge is of the "open" type and the value of R_1/R_{80} is 1·20. The voltage applied to the bridge for a pure solution being 1, the voltage for purities of 95, 90, 85, 80, 75 and 70 will be, respectively, 0·980, 0·934, 0·875, 0·795, 0·703 and 0·597. The agreement remains satisfactory and the maximum error in the working range is ±2% except for low purities.

Table VIII is constructed exactly in the same way as Table VII except that another type of thermistor is used, of which the parameter b is 3233°K and that the bridge is of the "closed" type, i.e. with $r = 2000$ ohms and $R_{80} = 468$ ohms. Then R_1 is found to be equal to 1500 ohms and the coefficients for impure solutions are practically the same as in Table VII. The agreement is still satisfactory as shown on the table.

Table VIII

Supersaturation measuring circuit according to GRUT's data and equation (6) when $b = 3233°K$, $R_{80} = 468$ ohms, $R_1 = 1500$ ohms, and $r = 2000$ ohms.

P $(1/k_P')$	t_s	$S = 0{\cdot}2$ K	$S = 0{\cdot}2$ $\Delta E/k_P'E$	$S = 0{\cdot}4$ K	$S = 0{\cdot}4$ $\Delta E/k_P'E$	$S = 0{\cdot}6$ K	$S = 0{\cdot}6$ $\Delta E/k_P'E$	$S = 0{\cdot}8$ K	$S = 0{\cdot}8$ $\Delta E/k_P'E$
100	60	0·011	0·0025	0·025	0·0055	0·040	0·0090	0·056	0·0129
	70	0·013	0·0025	0·028	0·0055	0·046	0·0090	0·065	0·0128
(1)	80	0·015	0·0024	0·034	0·0055	0·054	0·0090	0·077	0·0129
95	60	0·011	0·0025	0·025	0·0055	0·040	0·0090	0·057	0·0128
	70	0·013	0·0025	0·029	0·0055	0·047	0·0090	0·066	0·0129
(0·980)	80	0·015	0·0024	0·034	0·0055	0·056	0·0090	0·078	0·0129
90	60	0·012	0·0025	0·026	0·0055	0·042	0·0089	0·060	0·0128
	70	0·014	0·0024	0·030	0·0055	0·049	0·0089	0·069	0·0128
(0·934)	80	0·016	0·0024	0·036	0·0055	0·058	0·0091	0·082	0·0130
85	60	0·013	0·0025	0·028	0·0054	0·045	0·0089	0·063	0·0127
	70	0·015	0·0024	0·032	0·0055	0·052	0·0089	0·074	0·0128
(0·874)	80	0·017	0·0024	0·039	0·0055	0·062	0·0091	0·088	0·0130
80	60	0·014	0·0024	0·030	0·0054	0·049	0·0088	0·069	0·0126
	70	0·016	0·0024	0·035	0·0054	0·057	0·0088	0·080	0·0127
(0·794)	80	0·019	0·0024	0·042	0·0055	0·069	0·0091	0·097	0·0131
75	60	0·015	0·0024	0·033	0·0053	0·054	0·0087	0·076	0·0124
	70	0·018	0·0024	0·039	0·0053	0·063	0·0087	0·089	0·0125
(0·701)	80	0·022	0·0025	0·049	0·0056	0·079	0·0093	0·111	0·0134
70	60	0·017	0·0023	0·038	0·0051	0·062	0·0084	0·087	0·0121
	70	0·020	0·0023	0·045	0·0052	0·073	0·0086	0·103	0·0123
(0·594)	80	0·026	0·0025	0·058	0·0058	0·094	0·0096	0·113	0·0138

		$S = 1{\cdot}0$		$S = 1{\cdot}2$		$S = 1{\cdot}4$		$S = 1{\cdot}6$	
100	60	0·074	0·0170	0·092	0·0214	0·110	0·0259	0·128	0·0305
	70	0·085	0·0170	0·105	0·0213	0·126	0·0258	0·146	0·0305
	80	0·100	0·0171	0·123	0·0215	0·147	0·0260	0·170	0·0306
95	60	0·075	0·0169	0·093	0·0213	0·111	0·0258	0·130	0·0304
	70	0·087	0·0170	0·108	0·0214	0·129	0·0259	0·150	0·0306
	80	0·102	0·0171	0·126	0·0215	0·150	0·0260	0·173	0·0307
90	60	0·078	0·0169	0·097	0·0212	0·116	0·0257	0·136	0·0304
	70	0·090	0·0169	0·112	0·0213	0·134	0·0258	0·156	0·0305
	80	0·107	0·0712	0·132	0·0216	0·157	0·0262	0·182	0·0310
85	60	0·083	0·0168	0·103	0·0211	0·123	0·0256	0·144	0·0302
	70	0·096	0·0169	0·119	0·0213	0·142	0·0258	0·166	0·0305
	80	0·114	0·0172	0·141	0·0217	0·168	0·0264	0·194	0·0311
80	60	0·090	0·0167	0·112	0·0210	0·134	0·0255	0·157	0·0301
	70	0·104	0·0168	0·129	0·0212	0·155	0·0257	0·180	0·0304
	80	0·126	0·0174	0·155	0·0219	0·184	0·0267	0·213	0·0315
75	60	0·100	0·0164	0·124	0·0206	0·148	0·0251	0·173	0·0296
	70	0·116	0·0166	0·144	0·0210	0·172	0·0255	0·199	0·0302
	80	0·144	0·0178	0·177	0·0225	0·210	0·0273	0·241	0·0323
70	60	0·114	0·0160	0·142	0·0202	0·169	0·0245	0·197	0·0290
	70	0·134	0·0164	0·165	0·0207	0·197	0·0251	0·227	0·0297
	80	0·172	0·0184	0·210	0·0232	0·248	0·0282	0·284	0·0333

		$S = 1{\cdot}8$		$S = 2{\cdot}0$	
100	60	0·147	0·0353	0·165	0·0401
	70	0·167	0·0352	0·187	0·0399
	80	0·192	0·0353	0·214	0·0400
95	60	0·149	0·0351	0·167	0·0399
	70	0·170	0·0353	0·191	0·0401
	80	0·196	0·0354	0·219	0·0402
90	60	0·155	0·0351	0·175	0·0399
	70	0·178	0·0352	0·199	0·0401
	80	0·206	0·0358	0·230	0·0406
85	60	0·164	0·0349	0·185	0·0398
	70	0·189	0·0353	0·211	0·0402
	80	0·220	0·0360	0·245	0·0409
80	60	0·179	0·0348	0·201	0·0397
	70	0·205	0·0352	0·229	0·0400
	80	0·241	0·0364	0·267	0·0414
75	60	0·197	0·0343	0·222	0·0390
	70	0·227	0·0349	0·253	0·0397
	80	0·272	0·0373	0·302	0·0424
70	60	0·224	0·0336	0·251	0·0382
	70	0·258	0·0344	0·287	0·0391
	80	0·318	0·0385	0·351	0·0437

(*to be concluded*)

ICUMSA

H. C. S. DE WHALLEY (President), D. GROSS (Hon. Secretary)

THE meeting of the 12th Session is to be held at the National Bureau of Standards and the Hotel Shoreham, Washington, D.C., U.S.A., from 2nd to 6th June 1958. The Agenda of the 12th Session lists twenty-nine subjects. The earlier published list of Referees of subjects has been amended and now stands as follows:—

Subject No.	*Title.*	*Referee.*
1	Constitution and by-laws	H. C. S. DE WHALLEY (Gt. Britain)
2	Weighing, taring, sampling and classification of sugars	A. E. TATE (Gt. Britain)
3	Conductometric and gravimetric ash	K. SANDERA (Czechoslovakia)
4	Determination of reducing sugars in sugar products other than molasses and refined sugars	E. J. MCDONALD (U.S.A.)
5	Decolorizing tests for bone charcoal	E. P. BARRETT (U.S.A.)
6	Sucrose and reducing sugars in molasses	C. H. ALLEN (Gt. Britain)
7	Tables of refractive indices of sugar solutions	C. F. SNYDER (U.S.A.)
8	Quartz control plates	E. EINSPORN (Germany)
9	Tests for evaluation of the refining qualities of beet sugar	P. DEVILLERS (France)
10	Tests for evaluation of the refining qualities of cane sugar	C. W. DAVIS (Australia)
11	Specifications and tolerances of pure sucrose and reagents	J. HENRY (Belgium)
12	Tests for the evaluation of the crystallizing qualities of refinery liquors	A. VANHOOK (U.S.A.)
13	Colour and turbidity of sugar products and reflectance of solids sugars	T. R. GILLETT (U.S.A.)
14	Values of the Clerget divisor and methods for multiple polarization for sucrose and raffinose	J. DUBOURG (France)
15	Dry substance (total solids) in sugar products by drying, refractive index and other methods	S. D. GARDINER (Gt. Britain)
16	pH	D. GROSS (Gt. Britain)
17	Analysis and evaluation of refined sugars	G. P. MEADE (U.S.A.)
18	Design and standardization of laboratory apparatus	J. ANCÍZAR-SORDO (Colombia)
21	Lead error in raw sugar polarization	J. G. N. GASKIN (Gt. Britain)
22	Raffinose, other oligosaccharides and glycosides	A. CARRUTHERS (Gt. Britain)
23	Determination of sugars in sugar beets	H. HIRSCHMÜLLER (Germany)
24	Determination of factors causing deterioration of raw and refined sugars in storage and transport	H. E. C. POWERS (Gt. Britain)
25	Inorganic constituents of sugars and sugar products	R. SAUNIER (France)
26	Starch hydrolysis products	K. HEYNS (Germany)
27	Organic constituents of sugars and sugar products	P. HONIG (U.S.A.)
28	Microbiological counts in raw and refined cane sugars	I. R. SHERWOOD (Australia)
29	Microbiological counts in raw and refined beet sugars	R. WEIDENHAGEN (Germany)

The British West Indies has just formed a National Committee, which brings the total of affiliated Committees to fifteen. At least nine others are in the process of formation.

Delegates do not require a formal invitation, but their respective National Committees should advise the Hon. Secretary of the names of the delegates chosen to attend the Session, if not already done.

Persons not representing a National Committee and wishing to attend the Session as observers are requested to obtain formal approval for attendance.

No restrictions are imposed with respect to country of origin or size of sugar industry, but the limited space of the meeting rooms makes it necessary to limit the number of admitted observers. As previously announced, delegates and observers are to make their own arrangements with regard to travelling and accommodation and are strongly advised to do so without further delay. A list of suitable hotels is, however, available on request from the Hon. Secretary, Dr. D. GROSS, Tate & Lyle Ltd. Research Laboratories, Keston, Kent, England, or from the Hon. Organizer, Mr. C. F. SNYDER, National Bureau of Standards, Washington, D.C., U.S.A.

From information already to hand, it appears that a fairly large number of delegates and observers from various European countries will be present. The Session will thus provide a meeting and discussion place for most of the outstanding sugar chemists and experts of the world, with a scientific agenda surpassing even the ambitious programme of the last, 11th Session at Paris, 1954, the Proceedings of which are still available from the Hon. Secretary or Dr. H. B. HASS, Sugar Research Foundation Inc., 52 Wall Street, New York 5, N.Y., U.S.A. (price £1 or $3.00, including postage).

DISTRIBUTION OF DISTILLERY WASH AND FILTER-PRESS MUD BY ASPERSION

By W. Pretzman

In 1956, the distillery wash from Usina Santa Cruz, Campos, Brazil, was pumped out on to the fields instead of being run into the river Parahyba, as in previous years.

The total volume of approximately 10,000 litres per hour, with the addition of a similar quantity of water, was pumped through a 4-inch pipeline up to a maximum distance of 2000 yd. The last 1400 yd was composed of aluminium pipes with special couplings to facilitate quick change of position, and the liquid sprayed through eight nozzles under pressure in the form of overhead irrigation.

The success of this installation suggested the possibility of using the same method for distributing filter-press mud, the transport, unloading and spreading of which was becoming a considerable problem. With this end in view, the output of a single Oliver filter, approximately 2 tons of mud per hour, was passed through a conveyor with a perforated bottom plate and subjected to jets of water to separate the bagasse fibre from the mud. The diluted mud was then run by gravity into the tank receiving the distillery wash, while the fibres unable to pass through the perforated plate were run into the river.

The only alterations made to the original pumping installation were the substitution of the pump by an open rotor centrifugal pump, and the eight sprays for four special cannon-type sprays with 14 mm nozzles. The volume of liquid and the area to be treated are so calculated as to make a change of position necessary every 12 hours.

During this period some 280,000 litres are spread over an area of 150 sq. yd.

CORRESPONDENCE

CANE CRUSHING

To the Editor,
The International Sugar Journal Ltd.

Dear Sir,

Under the heading "Sugar-House Practice" in issue No. 704 of August 1957, the *I.S.J.* published an abstract of the article by Mr. W. P. MEANY which appeared in the *Jamaican Assoc. Sugar Tech J.* for 1955.

It is difficult to talk of a strict comparison between the two-roller mill and the three-roller mill. The two-roller mill was put on the market under the name of the Krajewski mill, and it is not very common, apart from its use as a defibrator, for the simple reason that the two-roller mill does not provide sufficient pressure for a determined tonnage, other things being equal. I am only quoting the opinion of Mr. GAVIGNET, who was Chief Engineer of the Sucreries d'Egypte and was particularly interested in cane crushing problems.

In the three-roller mill it is the entry roller which serves to feed the bagasse roller by way of the turn-plate and which permits the considerable pressure at the back by reason of this forced feeding. The function thus carried out by the feed roller, which is not only that of a compressor and volume-reducer, is confirmed by the efficiency of the rotary force-feeders which consist of a roller at the entry of the mill supplied by a feed plate. This arrangement, which CAIL has adopted on certain high-capacity tandems, has given remarkable results.

One could thus be led to conceive a multiple-roller mill in which cane is passed from one roller to the next by successive turn-plates. Such was the Brissoneau and Lotz mill, which has not survived, probably because of the complications in the operation and maintenance of the crushing equipment that such a system causes.

One may consider that if the current cane mill has taken the absolutely general form of a three-roller mill, that it is this form which fulfils the requirement of good extraction without exaggeratedly complicated construction; it is obvious, in fact, that the addition of a feed roller, even with a feed plate, does not represent the same operational restrictions as those of a supplementary turn-plate resulting from the construction of a four-roller mill. Nevertheless, the advantages which a two-roller mill presents and which have been recognized, as far as can be judged from the above-mentioned abstract, by the users, naturally classify it for filling the rôle of the first compressor even where the preparation is carried out beforehand with cane knives or a shredder.

We have thought it useful to recall this fact, although the two-roller mill used as a defibrator, which became more common during 1910–1940, appears today, for reasons which escape us, to be replaced by the three-roller mill in this use to which, it seems to us, to be ill-suited.

Finally, in our opinion, there is a place for both types of mill by reason of the characteristics appropriate to each, and it is for this reason that we wrote at the head of this note that it is difficult to speak of a strict comparison.

P. HARICOT,
Ex-Chief Engineer, Anc. Etbts. CAIL.

SUGAR-HOUSE PRACTICE

The Number and Size of Sugar Factories and Optimal Length of Campaigns. R. KARGL. *Listy Cukr.*, 1957, **73**, 109–117.—The development of the beet sugar industry in Czechoslovakia and other countries is analysed statistically and the question of optimal length of campaigns is discussed with the aid of graphs based on the factory overheads The optimal number of factories is considered and it is concluded that for Czechoslovakia it should be about 70, the campaign duration should be 67 days, and the optimal factory capacity about 1350–1500 tons of beet per day.

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The Influence of Water Quality on Refinery Processes. B. M. BRAGINSKAYA and M. T. MOLCHADSKII. *Sakhar. Prom.*, 1957, (3), 46–47.—The quality of the water used in the refinery depends greatly on its preliminary conditioning, the heating of the water before filtration through bone char being very significant in view of the savings in fuel and water for washing the filters, as well as removal of dissolved gases. pH values of water used at the Odessa refinery are 7·2 for raw water and 7·8 after heating and treatment with soda. The relative proportions of gypsum and calcium carbonate produced are discussed together with their removal from the filters.

* * *

The Supersaturation Coefficient, Quantity and Composition of Non-Sugars in Molasses. A. MIRCEV. *Listy Cukr.*, 1957, **73**, 102–104.—The importance of the coefficient of supersaturation in the sugar industry is discussed, especially with respect to crystallization and molasses formation, and with respect to the relationship between it and the nature of non-sugars and the purity of sugar solutions. Examples are given demonstrating the conditions under which this coefficient increases or decreases with purity of the sugar solution. The relationship between dry solids content of the molasses and the purity, between coefficient of supersaturation and purity, and between non-sugars content/water and supersaturation coefficient are demonstrated graphically. Examples are also given of conditions under which the coefficient remains unaltered.

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Incrustation and Salting-over of Superheaters and Turbines. B. BRUCKNER. *Zucker*, 1957, **10**, 223–225. The installation of a cylindrical vessel with Raschig rings in the steam pipe between the boiler and the superheater and in the water separator was found to prevent the carryover of the smallest drops of water and thus solve the problem of incrustation in the turbines at a German sugar factory. Iron rings were installed when it was found that steam at 200° made wooden rings brittle and mis-shaped, thus allowing the feed ports of the superheater to become incrustated and dusty. The pH of the water is discussed with reference to a number of authorities, and it is pointed out that this can only be decided on when the alkali content and the temperature are known, and depends greatly on the structure of the iron. Little is known of the effect of the alkali on the surface tension of the water in the presence of small amounts of foreign bodies, the tendency of water to foam depending on its surface tension, which is greater for boiler water with a very small NaOH content than for pure water at the same temperature.

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Diagrams of Heat Exchange in Sugar Factory Evaporator Stations. V. D. POPOV. *Sakhar. Prom.*, 1957, (4), 53–58.—Diagrams are given for the average working conditions of the basic evaporators taking scale formation into account. The determination of coefficients of heat transfer and flow at given concentration and temperature drop is demonstrated.

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The Rational Storage of Sugar in Warehouses. B. NOWAKOWSKI. *Gaz. Cukr.*, 1957, **59**, 93–96.—The moisture content of warehouses and of the stacked sugar is discussed. A system of ventilation is recommended in which warm air is circulated through floor vents below the bottom supports of the sugar pile. Optimal conditions for the sugar include cooling to 30–40°C before bagging, moisture content no higher than 0·05%, pH 6·8–7·4, and no invert content. For a warehouse of the type described (a diagram is given), which is 50 m long, 26 m wide and 7 m high, 80,000 cal/hr were needed to heat 6810 cu. m./hr from 18 to 60°C.

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Investigation of Continuous Massecuite Boiling using Morze's Patented Apparatus. T. PIETRZYKOWSKI. *Gaz. Cukr.*, 1957, **59**, 103–106.—Tests were carried out at Koscian factory during the 1955/56 campaign on a 14-chamber horizontal vacuum pan-crystallizer. Thick juice was evaporated to 76–80°Bx before entering the pan-crystallizer, where it was stirred and partially heated with a blast of hot air, sometimes with steam. Results are tabulated and it is concluded that the method is not applicable to factory use because: the grain size of the sugar produced was not suitable; the colour of the massecuite increased by 100% (compared with the usual 50%); the productivity was only half that of normal pans; the centrifuging time was much longer; and the white sugar yield from the massecuite was hardly 40%, with second sugar about 31%.

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Investigation of the First Saturation Process in a Spray Absorber and a New Method of Supplying Saturation Gas. I. D. STEPANENKO. *Sakhar. Prom.*, 1957, (4), 59–66.—A spray absorber comprising a sectioned cylindrical tower containing wooden conical grids is described. Juice flows downwards over the

grids beneath which are scrapers mounted on shelves for removal of any saturation juice, against an upward current of CO_2 which is blown by a fan. The power requirement for the fan is given as 2 kW per 10 cu. m. gas per min, compared with 30 kW with a rotary compressor, 20 kW with a turbo compressor, and 15 kW with a piston gas pump, for the same volume of gas. The upper part of the tower can be used for the predefecation and defecation stages at the same time as the saturation. Comparative data for the conventional saturator and the spray absorber are given and for the quality of juice with fast and slow saturation. Photo-micrographs of first saturation juice sediment are given.

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Destruction of Sugar by Bacteria in Sugar-House and Refinery. E. ANDERSEN. *Paper presented to the Tenth Conf. Comm. Int. Tech. Sucr.* (*C.I.T.S.*), May 1957.—A method of bacteria determination is described, whereby it is possible to obtain figures for both vegetative cells and spores, for spores alone, and with the culture medium containing $CaCO_3$, to differentiate between acid-producing and non-acid-producing bacteria. A method for determining the amount of thermophilic bacteria in the juices is also given. It is noted that the thick juice in the sugar factory is practically sterile, while the amount of infection developing in the juice throughout the factory is fairly evenly distributed. Infection from the air accounts for much of the bacteria carried into or developed in the sugar factory, but not for all. No fermentation is apparent in the juice above 40°Bx during short-period tests, though acid-producing bacteria have developed with a consequent drop in pH in samples incubated at 55°C for 8–14 days, even at 60°Bx. It is noted that bacteria can develop at low Brix, e.g. in condensate water containing sugar. Refinery conditions are distinguished by greater amounts of thermophilic bacteria (200–600/10 g) in the raw sugar, and by a possible increase in the amount of these in the sugar through use of bone char. The use of formalin in sweetening-off water is recommended for prevention of bacterial growth. A concentration of 0·01% formalin has been found adequate, the amount used being small in comparison with that used to prevent formation during diffusion. The formalin should be added immediately water enters the columns and not added when the Brix in the out-flow juice has dropped to levels at which bacteria can develop; it is pointed out that, during sweetening-off, areas may be formed in the column with lower Brix values than at the out-flow. Comparative figures of bacteria in various refinery products before and after formalin treatment are tabulated.

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On the Problem of Sucrose Inversion with Cation Exchange Resins. L. CAVALLARO and G. MANTOVANI. *Paper presented to the Tenth Conf. Comm. Int. Tech. Sucr.* (*C.I.T.S.*), May 1957.—The disadvantages of purification using ion exchange resins are discussed. Previous tests carried out on invert sugar formation due to the acidity of the cation exchange resin and modified methods of purification are generally reviewed. The laboratory study of the influence of organic non-sugars on the inversion process was based on agitation of the test solution in the presence of a constant quantity of cation exchanger for a given time at a given temperature. The tests were made on solutions of 20% sucrose, and 0·686% NaCl, at 40°C, in the presence of 4 g of resin per 50 c.c. solution for 30 min, organic non-sugar in the form of asparagine being added in varying quantities (0·5–1·5%). The results are tabulated and show a real salt effect exerted by the inorganic non-sugar (here NaCl) during ion exchange. The formation of invert is gradually reduced by the presence of the organic non-sugar in the presence of the inorganic non-sugars. It is noted that an increase in pH after ion exchange with an increase in the organic non-sugar content is not large enough for the reduced inversion rate to be attributed to it. Similar tests made with the same solutions, but without resin, showed a reduced salt effect, this pointing to the influence of organic non-sugar on the catalytic effect of the resin on the inversion process. Similar tests using pectins show no appreciable reduction in the inversion action of the resin, explained by the decrease in pH due to the pectin, but apparently also due to the fact that pectins are not fixed by cation-exchange resins, as is the asparagine. The reducing power of pectin is negligible. Tests are being made on other organic non-sugars and inert colloid substances such as silica.

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Feed-Water Problems in Natal Sugar Factories. K. DOUWES DEKKER. *S. African Sugar J.*, 1957, **41**, 281–285.—Scaling, corrosion and carry-over, due to the use of boiler feed-water containing undesirable constituents, are discussed. It is pointed out that none of the three types of water used in Natal cane sugar factories as boiler feed-water is ideal. Condensate from apparatus heated with exhaust steam usually contains oil, and may contain oxygen and sugar; condensate from evaporator vessels heated with vapour may contain sugar; and river or bore-hole water, unless conditioned very carefully, will contain ash constituents which may cause scaling. Scaling can be avoided completely by using condensate only, i.e. steam condensate plus vapour condensate. If feed-water is not properly de-aerated, corrosion may occur. The temperature of feed-water of many mills is so low that relatively large quantities of oxygen enter the boiler. Hence corrosion can be expected (and is experienced from time to time) both in boilers and on metal surfaces in contact with condensate of relatively low pH. Carry-over has been experienced in some mills. The cause is often the presence of oil in the boiler water, and the carry-over has led to dangerous deposits on the blades of the turbines. A number of analyses of deposits are given.

The use of Air Blowers for supplying Saturation Gas for Carbonatation. P. S. MAKSIMUK and N. KHODAK. *Sakhar. Prom.*, 1957, (2), 45–46.—An electric motor-driven air blower operating on the principle of a double rotor pump was installed in 1955 at the Kupyansk sugar factory for withdrawing CO_2 from the lime kilns and supplying it for carbonatation when a previous device became inoperative due to corrosion of the pumps by aqueous SO_2 present in the gas. Movement of the rotors is governed by gear transmission located outside the pump. In the absence of water no sulphuric or sulphurous acid is formed in such a device and the operational life is greatly increased.

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Methods of Increasing Sugar Yield and Decreasing the Number of Boilings. (II) A. MIRCEV. *Listy Cukr.*, 1957, **73**, 37–38. (III) IDEM. *Ibid.*, 39–40.

(II) The boiling of *C*-massecuites is discussed and a method described whereby the syrup is seeded with sugar powder and boiled to considerably reduced circulation (average 62% crystals on dry solids). Dilution syrup is added and air bubbled in through the sampling cock to mix the strike to a density low enough to drop (average 57·4% crystals on dry solids). After an hour in the minglers the massecuite passes to the centrifugals. Analytical data are provided and calculations of yields are given.

(III) Results are tabulated for ten boilings of first product refinery sugars. They were boiled very heavy and were then diluted with clear syrup from 57·7% crystal to 52·8%. Based on the results, it is possible to obtain an increased yield of 5% with lower losses and less boiling-back.

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Concentration and Quality of Clairce for Washing. I. F. ZELIKMAN. *Sakhar Prom.*, 1957, (3), 20–23.—The need for considering the concentration of clairce for washing sugar in the centrifugals is demonstrated. Recommendations for clairce concentrations are 70–72°Bx or even 75°Bx for washing refined sugar or pressed tablets, with more dilute clairce for removing the syrup coating from crystals of inadequate quality, or where low-grade seed is obtained from the massecuite and the mother-liquor has to be removed.

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Optimum Specific Load on the Heating Surface of Vacuum Pans. M. L. VAISMAN. *Sakhar. Prom.*, 1957, (3), 29–31.—The factors determining the optimal load on the heating surface of vacuum pans include: the heat steam parameters; the quality of original products; the method of boiling the massecuites; and the time spent on auxiliary operations. Tests were carried out with vacuum pans of heating surface 72·4 sq. m. and capacity 7·5 metric tons. Various amounts of second refinery massecuite were prepared, and the viscosity of the original syrup and of the final massecuite was determined, as well as the yield and quality of the sugar, the temperature cycle of the pan and various values influencing its performance. The tabulated results are for loadings of ca. 2, 2·5 and 3 cwt massecuite per sq. m. heating surface, and show that pan productivity is best with least massecuite (7·5 tons) and with a correspondingly low loading on the heating surface, when the performance is almost directly proportional to its heat transfer coefficient. The largest and most uniform crystals were obtained with highest loading (2·15 sq. m.). Where the sugar quality is not of utmost importance and the centrifugal capacity is sufficiently high, the productivity of the vacuum pan can be increased up to a definite limit by reducing the amount of massecuite boiled per cycle.

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(Syrup) Density Meter. P. N. KONOVALYUK. *Sakhar. Prom.*, 1957, (3), 38–40.—Syrup enters at the bottom of the apparatus, passes through an arrester screen and flows upwards through a freely-suspended brass tube which connects two dynamometers of equal diameter, each with a flexible membrane. The syrup acts on the upper membrane trying to push the movable system upwards, while also exerting a force on the lower membrane, striving to push it in the opposite direction. The membranes being of equal diameter, the forces are compensated without change of position of the movable system. The distance between the membranes is constant (500 mm) and so the indicated values depend on the specific gravity of the sugar solution. The pressure of the syrup in the column between the two membranes is compensated partly by the pressure of water filling the two dynamometers, which acts as a standard fluid. The difference between the two pressures is balanced by a spring located at the top of the apparatus. The instrument automatically corrects for temperature changes. The syrup leaves the instrument near the top on the opposite side to its entry. The range of the instrument is 0–75% dry solids, divisions being in 1% dry solids. Error is ±1% dry solids for a change of density of not more than 5% dry solids. The instrument, which is 495 mm long, 514 mm wide and 1475 mm high, weighs 135 kg, and has proved proved successful in tests under factory conditions.

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Ion Exchange in Sugar Factories. J. BURIÁNEK, K. CIZ, V. VALTER and K. SANDERA. *Listy Cukr.*, 1957, **73**, 41–45.—The theory of ion exchange, its use in feed-water preparation, the softening of juices, juice de-ionization, purification and decolorization, exchange resins and the molasses problem are reviewed. De-salting is only profitable if it is economically possible to recover the non-sugars. Increased alcohol production from green syrup fermentation is discussed.

Experimental Processing of Raw Cane Sugar. I. A. ROSTRIPENKO. *Sakhar. Prom.*, 1957, (4), 25–28.—Experimental refining of raw cane sugar at the Petrovsk No. 2 sugar factory was based on a four-boiling system using beet factory and refinery plant. Many difficulties were encountered at the start; the preheaters before defecation were particularly troublesome, being the main source of caramelization of the sugar, as a result of which they were excluded from the scheme. Reduction of the defecation time to 4–5 min improved clarification and speeded filtration. A greater amount of lime for defecation (2·5–3% CaO by weight of raw sugar) ensured good absorption on saturation, an appreciable reduction of colour of the syrups, and better filtration. Masse-cuite brix should not be higher than 90° as otherwise crystal growth is hindered. The purity of the syrup used for first product boiling was 98·2, falling to 61·9 after four boilings. The viscosity of the fourth product was not the same as that of third product beet sugar, in spite of its low purity (95·7).

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Reducing "Carboraffin" Consumption in Refineries. A. C. KLEINERMAN and L. I. LIBKIND. *Sakhar. Prom.*, 1957, (4), 29–30.—At a Russian experiment station it was found that large particles of bone char settled in the pipes, preventing juice flow with even the shortest delay. Replacement of half of the amount of "Carboraffin" used in the minglers for second refinery sugar (0·1% by weight of sugar) by 0·5% of fine bone char on weight of sugar at one refinery gave as good results as did 0·2% active carbon used alone. Thus, consumption of "Carboraffin" was halved.

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Stainless Steel Centrifugal Screens. A. C. KOSTENKO and V. T. PANASENKO. *Sakhar. Prom.*, 1957, (4), 35. Stainless steel wire centrifugal screens of wire 0·3 mm in diameter, used during the 1955/56 campaign at the Khmel'nits sugar factory, proved inadequate because of a tendency to sag, through lack of elasticity, and because the small size of the mesh increased the running time of the centrifugal. The screens also slipped when sugar was being removed. Screens of 0·7 mm diameter warp and 0·45 mm weft were used in 1956 and produced results very little different from those obtained by using brass screens, although the life of the stainless steel screens was considerably longer. Comparative data for first and second product sugars are tabulated.

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Protection against Breaks in Conveyor Belts as a Result of Slipping. N. I. YANKELEVICH. *Sakhar. Prom.*, 1957, (4), 38–39.—The breaking of a conveyor belt as a result of its reduced tension or overloading of the transporter is prevented by installing a centrifugal relay built into the bearing roller of the transporter. Movement of the roller causes ball bearings to bear down on lamellar springs, which turn a ring, which then relaxes pressure on a plate which has an annular contact. This plate then moves towards and makes contact with terminals, which form a circuit driving the conveyor motor. In the event of slipping, the speed of the roller decreases, the terminals break contact, and the motor stops. The mechanism can be installed anywhere along the conveyor, and is claimed to have many advantages over present centrifugal induction relays.

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Automatic Control for Regulating Fresh Water Supply to Hydraulic Conveyors. A. D. BAGLYUK. *Sakhar. Prom.*, 1957, (4), 45–46.—The supply of fresh water from the factory supply tank to supplement flume water in the reservoir (dependent on the level of wash water there) is regulated by an automatic control, which comprises a float attached to a connecting rod which is in turn attached to a shaft in the main body of the frame. When the level of the water drops, the rod drops with the float, turning the square-edged shaft, to which are attached sectioned rings, the holes in which correspond with holes in fixed rings. Thus, when the shaft revolves, the holes are aligned and the water enters through the feed port.

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The Application of A.C. Electric Motors and Control Gear. N. J. A. BONFA. *Proc. 30th Congr. S. African Sugar Tech. Assoc.*, 1956, 42-49.—Factors to be considered in the choice of electric motors and control gear are discussed. A list of the particulars required is given for motors and control gear, and typical average electro-mechanical characteristics of motors with their control gear given. Other aspects considered include: starting torque, motor rating (with special consideration of overload), multi-, variable-speed and flywheel drives, winding insulation, slip-rings, commutators and brushes, noise, over-current and fault protection, single phasing, starting, and power factor correction. It is pointed out that star-delta starters are suitable only for light starting. The failure of squirrel cage motors on centrifugals is discussed, overheating and fatigue due to vibration being suggested as probable causes.

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Boiler Efficiencies in Sugar Cane Mills. S. G. COLINESE. *Proc. 30th Congr. S. African Sugar Tech. Assoc.*, 1956, 50-56.—Tests for gauging the steam generator efficiency in sugar factories and the minimum equipment required are discussed, and test data given as a guide. A simple method of obtaining the dryness fraction of the steam from the boilers is described. CO_2 and CO recorders, flue gas analysers, feed-water meters and pyrometers are necessary, and the results of a test to determine the equivalent evaporation per lb bagasse fired and to prepare a heat balance are given as a guide. The Carnot cycle efficiency is considered to be purely hypothetical and not proven in practice. It was considered that the suggested removal of the rear baffle from a Babcock & Wilcox boiler would reduce the mass flow of gases and thus reduce heat transfer from gas to water, which might result in a reduction of evaporation.

Thickening of Suspension of Solids from Factory Juices and Waste Waters by means of Hydrocyclones. K. CÍHAL. *Listy Cukr.*, 1957, **73,** 12–14.—Hydrocyclone construction and theory are reviewed, with special discussion of the empirical equations of DAHLSTROM and TARJÁN for hydrocyclone performance and maximum size of separated particles. Hydrocyclones were used at the Sarkad (Hungary) factory during the 1955/56 campaign for purifying milk-of-lime, second saturation juice, and flume and wash waters. Under favourable conditions nearly 97% solids of 140 times the original concentration has been separated. Tests on flume water purification have shown 98% efficiency with a hydrocyclone of 80 mm diameter. For one month during the campaign one unit of 150 mm diameter was used for purifying milk-of-lime containing 212 g/litre of CaO and 2·65 g/litre of sand. The purified milk contained no sand so that separation was 100% efficient, while the thickened suspension contained 76·5 g/litre sand. 3·5% of the milk-of-lime contained impurities and was drawn-off through the muds withdrawal pipe, while 96·5% was withdrawn as cleaned milk-of-lime. With second saturation juice, 95·9% purification was achieved, with a solids content of 0·315 g/litre. The solids content of the muds was 31 g/litre. A group of ten hydrocyclones with a capacity of about 2000 litre/min was installed for second saturation juice.

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The Calculation of Rotary Diffuser Performance. E. T. KOVAL'. *Sakhar. Prom.*, 1957, (3), 15–20.—Equations are derived for the capacity of single and double helix rotary diffusers. That for the double helix diffuser is given as:—

$$A = 0{\cdot}074\ D^3\ \frac{\gamma\, n}{1 + 2\beta}\ \text{tons/hr},$$

where D = drum diameter in metres; γ = specific gravity of the cossette: juice mixture in tons per cu.m.; n = drum r.p.h.; and β = juice draw-off ratio. A double helix diffuser operated at maximum capacity and constant drum revolutions for ten days during September 1956 at Krasyansk sugar factory. The results are tabulated and show close agreement with values calculated from the formula.

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Comparative Tests of the Maceration-Diffusion Method in the Diffusion Battery. V. N. OSTAPENKO, P. A. MEL'NIK and I. M. AGRONSKII. *Sakhar. Prom.*, 1957, (3), 41–42.—The maceration–diffusion process which has been tested for two years at Korovinetsk factory comprises isolation of 1–3 cells for maceration of cossettes while the remaining cells operate normally. In tests carried out in January 1956, the maceration–diffusion process and the normal process were carried out side by side in two batteries, alternating these to avoid individual battery effects. Throughput of beets was increased by e.g. 11·4% without affecting losses, draught, or juice quality or viscosity. The process is suitable for treating frozen beet, and gives a juice of normal characteristics.

* * *

Experiences with Optimum Defeco-Carbonatation in Processing of Frozen Beets. D. BECKER. *Zucker*, 1957, **10,** 215–222.—The difficulties encountered in the processing of frozen beet during the past campaigns, including 1956/57, are reviewed with many references. The most difficult operation is the filtration of the first defecation juice, due to : a higher content of pectin decomposition products; the formation of albumin substances, caused by the frost and bacterial activity; and the presence of polymer carbohydrates, especially dextran. To overcome such difficulties during the last campaign, during three periods, optimum defeco-carbonatation and progressive return of defecation juice were adopted. The conditions prevailing during those three periods and the results achieved are tabulated. Clarifiers and rotary filters were found to be a good alternative to filter presses for separation of defecation and clear juices.

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Results of Storage Tests with Beet Pulp and Tops. G. ELMERS. *Socker Handl.* II, 1956, **12,** 189–195.—Experiments carried out in 1954/55 and 1955/56 on the storage of beet pulp and beet tops in concrete tanks of 2·4 cu. m. capacity are described. In tests in which the pulp was stored for about six months, it was found that increasing the pulp dry solids content by 1% enable about 8 kg more dry solids content per cu. m. to be stored. The compacted pulp (15% dry solids content) did not sustain greater losses than the ordinary pulp (11% dry solids) and when stored in drainless tanks will have much smaller losses, a further advantage with such tanks being that special collector tanks for the press water are not necessary. (The Water Conservancy Bill will forbid contamination of running water by discharged press water). The compacted pulp is as good as ordinary pulp for fodder. The addition of 3·5% molasses to the compacted pulp considerably reduced wet weight loss (e.g. from 23·8 to 13·1%). Extremely high losses resulted from the storage of beet tops alone, probably due to the inadequate size of the tanks. Press water flow from the tops can be decreased by placing 5% betfor (dried beet pulp containing beet protein and molasses) or 2½% peat litter in the bottom of the tank, the resultant flow being about the same as from the compacted pulp.

NEW BOOKS AND BULLETINS

Proceedings of the Fourth Technical Session on Bone Char, 1955. Ed. V. R. DEITZ. 442 pp; 7¾×10½ in. (Bone Char Research Project Inc., c/o Revere Sugar Refinery, 333 Medford Street, Charlestown 29, Mass., U.S.A.). 1956.

After a list and photograph of delegates to the 1955 Technical Session, the 1955 industrial sponsors and Board of Directors of the Bone Char Research Project Inc. are recorded, and a dedication of the volume is made to the late J. M. BROWN, who was Secretary-Treasurer of the Project from 1939 to the time of his death in 1956. A list of the papers presented to the Session follows, with the texts of those papers and the discussion aroused by them. The volume closes with a list of abbreviations used, and useful name and subject indexes.

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La Situación del Mercado Azucarero Mundial en los Años 1953 a 1957. (The Situation of the World Sugar Market in 1953–1957). L. MARINO PEREZ. 120 pp; 6 × 9 in. (L. Marino Perez, Edificio Blanco, 807—Belascoain 452, Havana, Cuba). 1957.

This small volume, privately printed for the author and dedicated to the Cuban Sugar Stabilization Institute (I.C.E.A.), collates much information on the production, consumption and movements of sugar for the U.S.A. and the major countries of Europe, with sections on the world sugar production and markets; the International Sugar Council; the relation of Cuba with the world sugar market; new sugar factories; bilateral sugar agreements; and a summary with conclusions. The author recommends, as a result of his studies, that an international reserve of sugar, sufficient for emergencies, should be set up under suitable controls, to provide a buffer effect which would enable the market to develop on more stabilized lines than it did during the period 1953 to 1956. The book closes with a reprint of an article by Dr. J. A. GUERRA describing the development of the Cuban sugar industry from 1932 to 1957, and listing the achievements both physical (increased production, etc.) and social.

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Selling to Industry. 52 pp; 6×9 in. (British Institute of Management, 80 Fetter Lane, London, E.C.4). 1957. Price: 5s 0d.

A group was set up by the British Institute of Management to study selling to industry in view of the differences between the marketing background of industrial and consumer goods. One of the group represented the sugar industry, who found, surprisingly enough, that his problems were unexpectedly similar to those of the electrical engineer. The report of the group shows the amount of common ground which quickly caused the disappearance of the initial reaction that the problems of the various industries in the group were too different to allow useful comparison. Chapters cover subjects ranging from planning, market research and appreciation, channels of distribution, and control, to recruitment and training of salesmen.

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Report of the Rothamsted Experimental Station, 1956. 280 pp; 6×9½ in. (The Rothamsted Experiment Station, Harpenden, Herts.). 1957.

It is difficult to extract from this intensive Report of the Rothamsted Experiment Station matter of direct interest to the sugar cane industry, the only specific reference to the tropics being that dealing with tropical soils. The major investigations are specifically of a fundamental nature, not intended to solve specific problems. Perhaps major interest attaches to the growing emphasis laid on the ecological aspect of the soil by the Soil Microbiology Department and, particularly, of the rhizosphere. A highlight of the year has been the installation of the electronic computer at full working capacity. This is used for the computation of not only the data derived from experiments at Rothamsted but at other research institutes. It is, perhaps, worth pointing out that there is an inherent danger in the growing divorce between responsibility for the accuracy of the collected data and that for the calculation and, to a certain extent, interpretation of the results. Of considerable interest is the special article attached to the Report in which W. W. EMERSON reviews the present state of knowledge of soil structure.

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Chronicles of Cannon Street. 64 pp; 6½ × 8¼ in. (Joseph Travers & Sons Ltd., 119 Cannon Street, London, E.C.2). 1957.

The sub-title of this small volume is "A few records of an old firm" and within is contained details of the history of Joseph Travers & Sons Ltd. from the days of its earliest surviving records, i.e. 1728, when JOSEPH SMITH, "Citizen and Grocer of London", dated his ledger "At the Sugar Loaf, Cannon Street". There has always existed the tradition in the Company that business was interrupted by the Great Fire of London in 1666 and, indeed, the 1728 records show that the business was then wholesale, with connexions all over England, which indicates that it had been established for some time. An interesting picture is built up of the period up to the present, with the personalities who built up the Company.

A chapter of "Miscellaneous Reminiscences" describes a wide variety of interesting facts of the Company's operation, while a separate section deals with the history of the firm since it became a Limited Company in 1889, including an account of the effects of both World Wars. The work concludes with an Index.

LABORATORY METHODS AND CHEMICAL REPORTS

The Influence of Sodium Glutamate on "Browning" and the Destruction of the Hexoses in Alkaline Solution. J. HENRY and R. PIECK. *Paper presented to the Tenth Conf. Comm. Int. Tech. Sucr.* (*C.I.T.S.*), May 1957.—Investigation of the Maillard reaction between the amino-acids and the reducing sugars and of the eventual alkaline degradation of the hexoses was carried out, paying special attention to the reaction rate and colour formation. The tests were carried out in an atmosphere of nitrogen at pH 8·2 and 9 at 80°C on solutions containing 15% sucrose and reducing sugars of concentration 11·1 or 22·2 millimoles/litre, these values being comparable to those of second carbonatation juices. The concentration of the sodium glutamate was 1·2–2·4 milliequiv. N % ml and NaOH or calcium saccharate was added to the solutions. The results show that the addition of sodium glutamate at pH 8·2 increased the reaction rate by 10–15%, and that colour (at 420mμ) was 20–30% greater with Na glutamate than without it. (This increased at the end of the reaction, the total increase being sometimes >50%, although precise final values were not established). Alkaline degradation of fructose produced a slightly greater coloration than that of glucose, this difference increasing to 20% in the presence of glutamate. The velocity constant using fructose changes, however, which may possibly be due to a Lobry de Bruyn–van Ekenstein inter-conversion. In the visible spectrum the glutamate had no effect on the optical nature of the coloration. At 80°C only one-third of the colour absorption was due to the Maillard reaction.

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The Destruction of Sucrose and of Invert Sugar in Beet Juice Processing. (I) The Formation of Volatile Acids in Factory Juices and the Estimation of these Acids by Gas-liquid Chromatography. J. F. T. OLDFIELD. **(II) Kinetics of Invert Formation and Destruction.** A. E. WOOTTON. **(III) The Formation of Lactic Acid in Relation to Sugar Loss.** M. SHORE. *Papers presented to the Tenth Conf. Comm. Int. Tech. Sucr.* (*C.I.T.S.*), May 1957.

(I) A gas-liquid chromatographic technique is described for estimation of volatile acids. Molasses is acidified with H_3PO_4 and water added to double the original volume. A 100 ml aliquot is applied to a column of anhydrous Na_2SO_4 and "Celite 545" and the acids washed out with alkali-extracted and dried ether. The acids are removed from the ether by a stream of dry nitrogen and transferred on to a liquid column of DC–550 silicone containing 10% w/w of stearic acid and 10% w/w of H_3PO_4, the whole being mixed with two parts of "Celite 545". The fractions carried through with the nitrogen carrier are titrated with 0·01 N NaOH by means of a micro-syringe delivering 100 μl drops. Results of analyses from 15 B.S.C. Ltd. factories are tabulated, and it is concluded that significant amounts of butyric acid are not normally present in British beet molasses and that propionic acid is present only on rare occasions, and then only in low concentration. Some of the acetic acid in molasses may arise from fermentation in the return water system or at the juice end of battery diffusers operated with low raw juice temperatures. Investigation of organic acid production during defecation indicated that all the formic acid in molasses could be accounted for by invert sugar degradation. Invert destruction during evaporation may be responsible for not more than 0·1% acetic acid in molasses, and it is considered that the difference between the concentration in molasses (0·22–0·80%) and that produced from invert during processing (0·1–0·2%) might be due to traces present in the fresh beet, to hydrolysis reactions not involving invert sugar, and to fermentation in the return water system.

(II) Kinetic equations are developed which are valid for production and destruction of invert under evaporation conditions (130°C, pH 8). So much of the invert produced is destroyed that invert measurement gives no guide to sucrose loss during evaporation. The complexity of thin juice composition invalidates results obtained using pure sucrose and invert solutions, and further knowledge is required of the inter-relationships of pH, temperature, ionic strengths and invert production and destruction rates in beet juices.

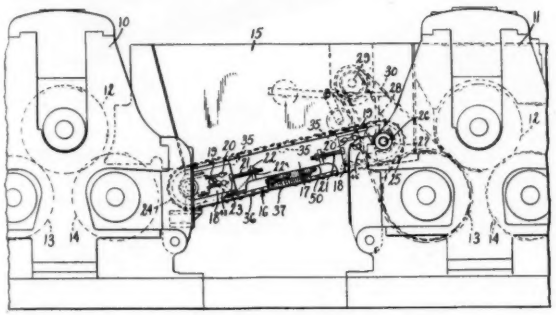
(III) A technique is described for lactic acid estimation by adsorption on "Deacidite FF", a strongly basic anion exchange resin, followed by elution with 0·1 N HCl. Molasses analyses are tabulated, and the factory processes investigated to determine the source, since lactic acid content of fresh beet is negligible. The three main ways in which lactic acid is produced are: bacterial fermentation of sugar during diffusion (when >90% of the acid produced is lactic); degradation of invert sugar during defecation (when 40% of the acid produced is lactic); and invert degradation at pH 7–8 and elevated temperature (when 13–15% of the acid produced is lactic).

* * *

Determination of Raffinose and Kestose in Sugar Beet by Paper Partition Chromatography. A. K. KARTASHEV and V. A. SERDYUK. *Trudy Vsesoyuz. Tsentr. Nauch.-Issledov. Inst. Sakhar. Prom.*, 1956, **4**, 194–200; through *S.I.A.*, 1957, **19**, Abs. 272.—Ascending chromatography, using 4:1:5 *n*-butanol–acetic acid–water mixture as solvent, and 0·5% of α-naphthol solution as spraying reagent, gave the best results. Raffinose accumulates (up to 2% of the total sugar in the beet) only in abnormal growth and storage conditions; prolonged storage (up to June), even in normal conditions, may result in the formation of kestose.

UNITED STATES

Conveyor Mechanism for Sugar Mills. P. V. TIPPET, assr. FARREL-BIRMINGHAM CO. INC., of Ansonia, Conn. **2,783,870.** 27th April 1953; 5th March 1957. A conveyor for transporting cane from one mill to another comprises a rubber belt 36 mounted on a frame 17 which is supported by side plates 15 between the mills. The belt has bevelled cross-ribs 37 on the outer face for easy scooping of the cane and with guide lugs on the inner face which prevent buckling of the belt as it rotates around the drums 24, 25. A number of small supporting rollers 35 are mounted



in pairs on common shafts adjacent to the upper edges of frame 17, one end of each roller in the outside members of the frame and the other ends on opposite sides of a central longitudinal member. The lugs on the inner face of the belt are received by an annular groove in each of the drums 24, 25, and are thus guided over the space between the longitudinal members. This prevents lateral movement of the belt. The drums are cleaned by two scrapers, 43 and 45, which are pivoted on rods attached to the bearing plate 18.

* * *

Separation of Valuable Organic Compounds (Glutamic Acid and Betaine) from Molasses. J. VAN JULSINGHA, assr. N.V. CENTRALE SUIKER MIJ., of Amsterdam, Holland. **2,785,179.** 15th October 1953; 12th March 1957.—Molasses is diluted with an organic liquid (methanol) to the extent of 0·6–2·0 kilos (1 kilo) per kilo of molasses. The solution is acidified to pH 1–6 (2–3·5) with an acid forming insoluble salts with cations present (H_2SO_4). The precipitate is separated and the organic liquid evaporated. The resulting solution is diluted to 20–30°Bx and passed successively through a cation and an anion exchanger in that or the reverse order, following which glutamic acid and pyrollidone carboxylic acid are eluted from the anion exchanger and betaine is recovered from the cation exchanger.

Decolorizing Sugar Solutions with a Porous Quaternary Ammonium Anion Exchanger. F. H. HARDING and F. BRUDER, assrs. ROHM & HAAS CO., of Philadelphia, Pa. **2,785,998.** 25th November 1953; 19th March 1957.—An affined and clarified sugar solution at 40–70°Bx is passed through a layer of particles of a quaternary ammonium anion exchange resin in the chloride form, at a temperature of 130–210°F (140–190°F), thereby removing colour bodies. The resin is regenerated by treating it with a solution of NaCl and a mild oxidizing agent (H_2O_2 or NaOCl).

* * *

Acid Hydrolysis of Dextran in presence of Activated Charcoal. M. D. FORD and L. J. NOVAK, assrs. THE COMMONWEALTH ENGINEERING CO. OF OHIO, of Dayton, Ohio. **2,787,562.** 12th December 1951; 2nd April 1957.—Aqueous solutions of hydrolysed dextrans containing little colouring matter and fractions of mol. wt. about 10,000 are produced by adding adsorbents, e.g. about 5–10% by weight of finely divided activated charcoal, to a solution of high mol. wt. native dextran in aqueous solution acidified to pH 1·04, plus 20% by vol. of isopropyl alcohol at the commencement of hydrolysis (or at any stage before neutralization of the solution). After neutralization the solution is filtered at 85°C to remove charcoal and adsorbed materials, and the dextran may be precipitated from the neutral solution by adding isopropyl alcohol. The number of fractionations for removal of low mol. wt. dextran is thereby reduced.

* * *

Process for Recovering Glutamic Acid. J. L. PURVIS, assr. INTERNATIONAL MINERALS & CHEMICAL CORP, of Chicago, Ill. **2,788,368.** 7th July 1954; 9th April 1957.—Steffen's filtrate concentrated to S.G. 1·2–1·4 is acidified with conc. H_2SO_4 at 70°C to pH 2–2·9 to remove inorganic salts, and hydrolysed at 100–125°C for ¼–4 hr with a non-oxidizing inorganic acid (conc. HCl) to give pH 0·2–1·0 (0·6). The product is separated into two fractions, *A* and *B*, *A* containing about 20–60% hydrolysate liquor, *B* solid material and remaining liquor. *B* is treated with an alkali (aqueous NaOH) to give pH 4–6 (4·5–5·5). The insoluble material is separated from *B*, which is then concentrated to a viscosity of 325–425 centipoises (55–90% by weight of filtrate) at least to crystallization of the salts, these being then separatated and *B* treated with *A* to give a pH of 3·2. Glutamic acid of 85–95% purity crystallizes and is recovered by centrifugalling. After treatment with HCl the mother-liquor is cooled to 0–35°C (20°C) to allow crystallization of betaine hydrochloride which is removed by centrifugal.

TRADE NOTICES

The Fischbein Portable Bag Closer. The Thames Sack & Bag Co. Ltd., Smithfield Wharf, Furze Street, London, E.3.

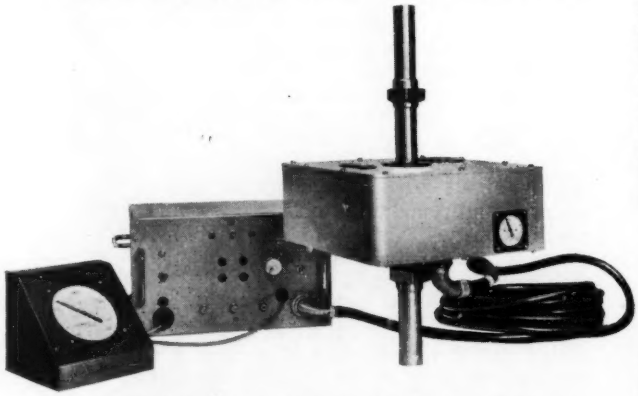
The Fischbein unit weighs only 10½ lb including a cone of thread, and needs only to be connected to an electrical outlet. It is held in one hand and guided along the top of the bag which is held in the other hand. The stitch range is 4–5½ stitches per inch, and a protected cutting blade severs the thread after the bag is closed. Any textile or paper bag can be handled, and the average 100 lb bag is closed in less than 6 seconds.

Where multiwall paper sacks are in use, the "Faseal" attachment can provide a reinforcement against the weakening effect of perforations by means of a crêpe strip which fits over the top of the sack. The strip is severed by a miniature guillotine which cuts this and the stitching thread at the same time. A mirror is incorporated so giving the operator an uninterrupted view of the working of the machine. When transferring to another type of bag, the "Faseal" attachment can be taken out of use by means of a spring-loaded lever and does not need to be unscrewed or dismantled.

* * *

The R.300 Photo-Electric Recording Refractometer. Bellingham & Stanley Ltd., 71 Hornsey Rise, London, N.19.

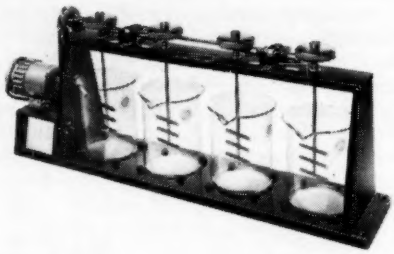
Measurement of the refractive index of sugar solutions at a number of places at considerable distances from the recording point is possible using the new photo-electric recording refractometer. Up to six instruments can be installed giving presentation on the same recorder, and the changes can thereby be directly related to changes which have taken place in other variables, such as steam pressure, pH, etc. The refractometer may be applied to measurement of liquids flowing in a pipeline that are clear and free from suspended particles. The instrument can



be calibrated to the user's requirements and has a scale length of 11¾ inches, and covers, for instance, 60–80% of sugar with an accuracy of ±0·2% of sugar.

Laboratory Flocculator. Paterson Engineering Co. Ltd., Windsor House, Kingsway, London, W.C.2.

A new item of laboratory equipment of interest to chemists is the Laboratory Flocculator, by means of which up to four small-scale treatment tests can be carried out simultaneously. It consists of a black enamelled pressed steel frame from which are sus-



pended four stirrer paddles driven by a small geared electric motor mounted on a platform at one end of the frame. The whole is fixed to a black base of chemically-resistant material.

The drive is transmitted by a flexible belt to a main shaft and by gearing to two auxiliary shafts, each of which drives two of the stirrer paddles. By altering the position of the driving pinion on the shaft relative to the driven disc the speed of each paddle can be individually regulated. The paddle speeds are determined by reference to the position of the pinion on the shaft, a chart mounted on the frame showing paddle speeds over the full range of the instrument.

The driven discs, which have a plastic lining, are integral with the paddle shafts, and by raising these the glass vessels can be placed in position beneath them. Oilite bearings are used throughout the drive mechanism, the other fittings being chromium-plated. The motor, with a normal output speed of 45 r.p.m., gives the paddles a range of 6–19 r.p.m. with one pulley setting and 20–60 r.p.m. with the other. The Flocculator can be supplied to suit any input voltage and speed requirements.

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PUBLICATIONS RECEIVED

HARVESTER ROUND, 1957, Vol. 11, Round 7. The International Harvester Co. of Great Britain, City Road, London, E.C.1.

This issue of the Company's magazine contains a brief but well and profusely illustrated article entitled "Canefields of the Caribbean" which deals with mechanization from cultural practice to delivery at the factory.

International Sugar Agreement

Initial Export Quotas and Permissible Exports for 1958

	Metric tons, raw value
Initial Export Quotas:	
Belgium	55,000
China (Taiwan)	655,000
Cuba	2,415,000
Czechoslovakia	275,000
Dominican Republic	655,000
France	20,000
Haiti	45,000
Hungary	40,000
Mexico	75,000
Kingdom of the Netherlands	40,000
Philippines	25,000
Poland	220,000
U.S.S.R.	200,000
	4,720,000
Permissible Exports under Article 14a(4):	
Nicaragua	5,000
Panama	5,000
Permissible Exports under Article 14a (6 bis):	
Portugal	20,000
Special Reserve, Article 14a bis (6 ter):	
China (Taiwan)	95,000
Philippines	20,000
Total Initial Export Quotas and other Permissible Exports	4,865,000

U.S. 1957/58 Beet Crop.[1]—U.S. domestic beet production for the current crop is estimated by the Crop Reporting Board of the U.S. Dept. of Agriculture at 15,173,000 short tons, which is a record figure, 16·6% higher than last season's production and 8% above the previous record crop of 14,082,000 tons produced in 1954. The yield at 17·3 tons per acre is 0·7 tons above last season's record yield.

* * *

U.S. Cane Harvester.[2]—Engineers of the U.S. Dept. of Agriculture are reported to have succeeded in constructing a self-driven cane harvester capable of simultaneously cutting, trashing and loading cane. It weighs about 15,000 lb and could be manufactured at a price of about $18,000. However, the machine is applicable only for harvesting upright canes.

* * *

Brazil Statistics.—Details for the crop year June 1956 to May 1957 are given below, with comparative figures from the previous crop year (metric tons):—

	1956/57	1955/56
Initial stock	154,175	218,417
Production	2,248,390	2,112,500
	2,402,565	2,330,917
Consumption	1,994,456	1,886,651
Exports	30,372	290,091
	2,024,828	2,176,742
Final stocks	377,737	154,175

The New York Sugar Trade Laboratory

On 2nd December 1957 the New York Sugar Trade Laboratory marked the 50th anniversary of its founding.

The Laboratory came into being largely through the efforts of the late JOHN ARBUCKLE to eliminate the disputes which used to arise in the sugar trade over discrepancies in the polarization of raw sugars reported by different chemists on the same sample. The necessity of engaging a referee chemist occurred so frequently that the members of the trade decided to establish their own laboratory. During the summer of 1907, Dr. C. A. BROWNE, then Chief of the Sugar Laboratory of the National Bureau of Standards, Washington, D.C., was invited to set up the proposed laboratory. In the autumn of the same year Dr. BROWNE became chemist-in-charge of what is now known as The New York Sugar Trade Laboratory and served in this capacity until 1st October 1923.

Upon the resignation of Dr. BROWNE in 1923, Dr. F. W. ZERBAN, then Director of Research at Penick & Ford, was selected to fill this position. He directed the work of the Laboratory until his retirement in April 1955. Dr. ZERBAN co-authored with Dr. BROWNE the "Handbook of Sugar Analysis" and this book is widely used as a reference for the methods of sugar and molasses analysis.

Since Dr. ZERBAN'S retirement in 1955, Dr. W. W. BINKLEY, former research associate in sugar chemistry at the Ohio State University, has been the chemist-in-charge.

The Laboratory is a corporation supervised by a board of directors, two of whom represent the buyers and the other two the sellers of sugar. It tests approximately 17,000 sugar and 1000 molasses samples annually at its location, 37 Warren Street, New York 7, N.Y.

Norway Factory Possibility.[3]—Following successful beet growing experiments in Norway last year, the construction of a sugar factory is being discussed by interested circles.

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Greek Factory Tender.[4]—A meeting of Ministers on 7th November recommended the invitation of tenders for a sugar factory of 2000 tons per day slicing capacity to be erected in the Larissa region of central Greece. The cost is estimated at $4–5m, and other factories are expected to be built at a later date.

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U.S. Domestic Quota Hearings.[5]—The U.S. Dept. of Agriculture in Washington held its hearings on United States 1958 sugar marketing quotas on 19th November. Representatives of U.S. and foreign sugar interests asked the Department to reduce quotas for 1958, while witnesses for industrial users asked that the quotas be increased. The quotas would be established and probably announced by the Department during the week beginning 23rd December 1957.

[1] *Lamborn*, 1957, **35**, 241.
[2] F. O. LICHT, *Int. Sugar Rpt.*, 1957, **89**, (Supp. 22), 7.
[3] F. O. LICHT, *Int. Sugar Rpt.*, 1957, **89**, (11), 9.
[4] F. O. LICHT, *Int. Sugar Rpt.*, 1957, **89**, (Supp. 22), 11; C. Czarnikow Ltd., *Sugar Review*, 1957, (330), 199.
[5] *Public Ledger*, 23rd November 1957.

BREVITIES

Italy Sugar Beet Production.[1]—Production of sugar beet last year amounted to about 5·9 million metric tons, compared with 7,054,500 tons in 1956. The area sown was about 220,000 hectares, compared with 224,769 hectares in 1956.

* * *

Cuban Technologists' Meeting.[2]—The 31st Conference of the Cuban Association of Sugar Technologists was to be held in Havana during 4th–6th December 1957. Twenty-three papers presented include : five to the Agricultural Section, seven to the Manufacturing Section, eight to the Engineering Section, and three to the By-Products Section.

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Antigua Sugar Factory Ltd. 1957 Report.—Crop started on 14th January. As a result of prolonged drought conditions the out-turn amounted to only 31,985 tons of sugar from 266,100 tons of cane, compared with the original estimate of 35,000 tons. Sugar for export, a total of 30,358 tons, included 24,533 tons sold to the Sugar Board under the Commonwealth Sugar Agreement, and 5825 tons sold on a favourable free market. Recent alterations and improvements made to the factory justified expectations, although the higher grinding rate caused the mills to run out of cane occasionally. This should be remedied by some addition to rolling stock. The outlook for 1958 is not very bright owing to the ill-effects on the new cane resulting from the drought. A dividend of 10% free of tax is recommended.

Stock Exchange Quotations

London Stocks (*at 18th December* 1957)	CLOSING MIDDLE
Anglo-Ceylon (5s)	12/7½
Antigua Sugar Factory (£1)	21/3
Booker Bros. (10s)	16/9
British Sugar Corp. (Ltd. (£1)	14/9
Caroni Ord. (2s)	4/–
Caroni 6% Cum. Pref. (£1)	17/3
Distillers Co. Ltd. (6s. 8d units)	21/1½
Gledhow Chaka's Kraal (£1)	54/–
Hullett & Sons (£1)	66/–
Incomati Estates (£1)	2/6
Jamaica Sugar Estates Ltd. (5s units)	7/–
Leach's Argentine (10s units)	6/6
Reynolds Bros. (£1)	45/6
St. Kitts (London) Ltd. (£1)	48/9
Ste. Madeleine (Ord.) (£1)	25/6
Sena Sugar Estates (10s)	26/3
Tate & Lyle (£1)	55/4½
Tate & Lyle Investments Ltd. (5s)	10/–
Trinidad Sugar (5s stock units)	8/–
United Molasses (10s stock units)	28/9
West Indies Sugar Co. Ltd. (£1)	28/–

New York Stocks (*at 17th December* 1957)	CLOSING MIDDLE $
American Crystal ($10)	30
Amer. Sugar Ref. Co. ($100)	25
Central Aguirre ($5)	19
Cuban American ($10)	18
Great Western Sugar	20½
South P.R. Sugar	30
United Fruit Co.	35½
West Indies Sugar Corp. ($1)	67½

Newsprint from Indian Bagasse.[3]—The Indian Minister for Industry stated on 24th August that a German company had recommended the adoption of its patented process for the production of 30,000 tons of newsprint per year at Shakarnagar in Andhra Pradesh, utilizing bagasse available from the sugar factory there. Implementation of the scheme is dependent upon the negotiation of suitable credit terms for the procurement of plant and equipment.

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U.S. Beet Acreage.[4]—The U.S. Department of Agriculture announced on 8th October that the acreage allotment for the 1958 crop of sugar beet was to be set at 915,000 acres, which compares with the final allotment of 950,000 acres established for 1957. Except for 2500 acres set aside as a national reserve, the entire acreage has been allocated to States under the proportionate shares acreage limiting condition laid down in the Sugar Act.

* * *

Taiwan–Japan Trade Agreement.[5]—Under the terms of an Agreement signed in Tokyo on 31st August, exports of sugar from Taiwan account for the major part of the increased exports to Japan, and include raw sugar to the value of $40,000,000 and brown sugar to the value of $1,500,000.

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U.S. Sugar Act Definitions.—Final definitions have been announced[6] for distinguishing raw from direct consumption sugar. The definitions are essentially the same as those proposed on 26th June last, with the sugar content dividing line established at 99% and ash content (in the case of liquid sugar) at 0·20%. The new regulation has become effective from 1st January 1958.

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Overhead Irrigation in Southern Rhodesia.[7]—A contract worth more than £325,000, has been placed with a Salisbury firm for the supply and installation of an overhead spray irrigation system at Triangle Sugar Estates covering over 4000 acres. About 2000 acres are expected to be planted and put under spray irrigation by February 1958 and the remainder by April. Triangle Sugar Estates were acquired by Sir J. L. Hulett & Sons Ltd. last June.

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U.S.S.R. Sugar Situation.—According to *Pravda*[8], over 1,200,000 hectares are planted to sugar beet in the Ukraine, and higher root weights and sucrose content than last year are reported. Many of the collective farms have produced 30–40 metric tons per hectare and some 50–70 tons. There are over 15,000 combine harvesters working in the Ukraine and they will deal with 70% of the total crop. Loading of sugar beet on to lorries, hitherto done mainly by hand, is also being mechanized, with about 2500 loaders put into operation. The 1957/58 campaign[9] started on 9th August 1957, when Kuban No. 1 factory in the Krasnodar territory of the Russian Republic started slicing, followed by Kuban No. 2 on 14th August. During the Sixth Five-Year Plan, some 29 sugar factories are to be built, including 14 in the Russian Republic under construction in 1957 with an aggregate slicing capacity of 28,400 tons. In the Tatar Autonomous Republic, two factories of 1200 tons and 1500 tons capacity respectively are to start operations in the 1959/60 season.

[1] C. Czarnikow Ltd., *Sugar Review*, 1957, (329), 194.
[2] *Bol. Ofic. A.T.A.C.*, 1957, **16**, 499.
[3] *Indian Trade J.*, 1957, **201**, 743.
[4] *Lamborn*, 1957, **35**, 217.
[5] *Board of Trade J.*, 4th October 1957.
[6] *B. W. Dyer & Co.*, 4th November 1957.
[7] *Public Ledger*, 9th November 1957.
[8] 10th September 1957.
[9] *Sakhar. Prom.*, 1957, (7) ; (8) ; (9).